

ANNEX 16

MASTER PLAN ON SSWRD IN TANGAIL DISTRICT

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF LOCAL GOVERNMENT,
RURAL DEVELOPMENT AND COOPERATIVES (MLGRD&C)
LOCAL GOVERNMENT ENGINEERING DEPARTMENT (LGED)

**MASTER PLAN STUDY
ON
SMALL SCALE WATER RESOURCES DEVELOPMENT
FOR
POVERTY ALLEVIATION THROUGH EFFECTIVE USE OF SURFACE WATER
IN GREATER MYMENSINGH**

**MASTER PLAN
OF
SMALL SCALE WATER RESOURCES DEVELOPMENT
IN
TANGAIL DISTRICT**

NOVEMBER 2005

PACIFIC CONSULTANTS INTERNATIONAL (PCI), JAPAN

**TANGAIL DISTRICT
DHAKA DIVISION**



LEGEND

Administrative Boundary	Physical Infrastructures	Natural Features	Socio-economic Infrastructures
International Boundary	National Highway	Wide River	Smart Circle
National Boundary	Regional Highway	Water Bodies	Small Facilities
Upazila Boundary	Zip Road	Canal	Police Station
Union Boundary	Upazila Road Pucca		Spillover Health Complex
Municipal Boundary	Upazila Road Kutta		College
	Union Road Pucca		High School
	Union Road Kutta		University
	National Canal		
	Railway Station		
	Feeder Road		
Administrative HQs			
Union HQ			
Upazila HQ			
District HQ			

SCALE 1:50,000
 0 1 2 3 4 5 6 Kilometers
 11.748 N 87.9800 E
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 11.748 N 87.9800 E

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Map of Tangail District

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Abbreviations

ADB	Asian Development Bank
BADC	Bangladesh Agricultural Development Corporation
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorological Department
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CAD	Command Area Development
DAE	Department of Agricultural Extension
DFID	Department for International Development of UK
DI	Drainage Improvement
DIWC	Drainage Improvement and Water Conservation
DOC	Department of Cooperatives
DOE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DTW	Deep Tubewell
EIRR	Economic Internal Rate of Return
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCDI	Flood Control, Drainage and Irrigation
FD	Forestry Department
FM	Flood Management
FMDI	Flood Management and Drainage Improvement
GDP	Gross Domestic Product
GIS	Geographical Information System

HQ	Headquarter
HTW	Hand Tubewell
HYV	High Yield Variety
IEE	Initial Environmental Examination
IFAD	International Fund for Agricultural Development
IMCC	Inter-ministerial Coordination Committee set under the TAPP
JICA	Japan International Cooperation Agency
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
LGI	Local Government Institutions
LLP	Low Lift Pump
M&E	Monitoring and Evaluation
MIS	Management Information System
MLGRD&C	Ministry of Local Government, Rural Development and Co-operatives
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forest
MoFL	Ministry of Fisheries and Livestock
MoL	Ministry of Land
MoWR	Ministry of Water Resources
NGO	Non-Governmental Organization
NWMP	National Water Management Plan
NWPo	National Water Policy
NWRD	National Water Resources Database
O&M	Operation and Maintenance
PMO	Project Management Office
PRA	Participatory Rural Appraisal
PWD	Public Works Datum (0.0 m PWD = 0.457 m of SOB datum)
SOB datum	Survey of Bangladesh datum (identifiable with mean sea level)
SP	Subproject
SSWRDSP	Small-Scale Water Resources Development Sector Project
STW	Shallow Tubewell
TIP	Thana Irrigation Program
TK.	Taka, US\$ 1.00= Tk 57.4 as of October 2004
UDCC	Upazila Development Coordination Committee
UP	Union <i>Parishad</i> (Council)
UE	Upazila Engineer
WARPO	Water Resources Planning Organization
WC	Water Conservation
WMA(WMCA)	Water Management (Cooperative) Association

Chapter 1 Outline of the Master Plan Study

1.1 Background

The provisions of the National Water Policy (NWPo) of 1999 states that the local government and relevant agencies are responsible for planning and execution of water management based on the National Water Management Plan (NWMP) approved by the National Water Resources Council (NWRC) on 31st March 2004, and in regard to the regional features of local water resources¹.

The Government of Bangladesh (hereinafter referred to as “GOB”), with the support from ADB, IFAD and the Government of the Netherlands, has carried out the Small Scale Water Resources Development Sector Project (SSWRDSP-1) aiming at the rehabilitation and improvement of small-scale water resource management systems. The project was carried out from 1995 covering 37 districts of the western part of Bangladesh. Following the same concept, the second phase of this project (SSWRDSP-2), covering 61 districts throughout the country commenced in 2003 with the planned period of 7 years. However, from lessons learned from SSWRDSP-1, the preparation of district level small scale water resources development plans are recognized to have significant importance for further implementation of SSWRDSP.

Under such circumstances, the GOB requested the Government of Japan (hereinafter referred to as “GOJ”) for technical assistance regarding the preparation of district level plans for small scale water resources development (SSWRD), which will be considered as the basic development plans at district levels. In response to the GOB’s request, the GOJ dispatched a Preparatory Study Team from February to March, 2004, and signed the Scope of Work for *the Master Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water in Greater Mymensingh of Bangladesh* (hereafter referred as “the Study”) on February 25, 2004.

Based on the Scope of Works, the JICA Study Team, carried out the Study in Bangladesh from July 18, 2004 to July 23, 2005.

1.2 Objectives and Scope of the Study

(1) Objectives

The overall goal of the Study is *to secure safe and sustainable water resources management and to increase farmers’ income*, and objectives of the Study are;

- 1) to formulate Plan for SSWRD in Greater Mymensingh comprising program of priority programs, and the scope for the follow-on investment projects which include effective use of surface water, and
- 2) to enhance and strengthen the capacity of the counterpart in preparation of the SSWRD Plan

(2) Scope of the Study

The Study is conducted in the following 2 phases:

- Phase I: Field Survey in wet season, Identification of problems on SSWRD in the Study Area (July 2004 to November 2004)
- Phase II: Field survey and Formulation of Small Scale Water Resources Development Plans (January 2005 to July 2005)

The Study will consist of the following study items.

1) Data Collection and Analysis

- (a) Collect and review the existing data and information on physical, socio-economical and institutional settings, including hydrology, water availability and quality, land use, population, poverty and other human development indices, income, gender issues and occupational patterns; and collate the same with project objectives and outputs.
- (b) Assess the performance and issues of the economic activities of the Sub-districts (Upazila),

¹ Outline of the NWPo (1999) is shown in Table 1.1.

- including agriculture, fishery, forestry, and other natural resources, roads and road transport, water supply and sanitation.
- (c) Collect information on the ongoing and proposed interventions in the Upazila in water and other relevant sectors
- 2) Inventory Survey and Participatory Rural Appraisal (PRA)
- (a) Carry out the inventory survey of existing infrastructure related to water resources, along with their status and location maps
- (b) Select potential areas for SSWRD
- (c) Undertake PRA at representative Unions and Upazilas that includes the potential area and assess the following: i) development status, needs and priorities; ii) water-related problems, their causes and proposed solutions; iii) stakeholders' views on the ongoing and proposed initiatives; and iv) stakeholders' willingness to contribute to the construction, operation and maintenance (O&M).
- 3) Preparation of Master Plan for SSWRD with the Target Year of 2015
- (a) Strategies and priority programs which could include flood management, irrigation and drainage, agriculture and fishery extension, rural water supply, arsenic mitigation, and institutional strengthening.
- (b) Preparing guidelines for project assessment
- (c) Preparing prioritized list of sub-projects
- (d) Preparing Action Plans
- 4) Technology transfer to counterpart personnel
- (a) On-the-job training in the process of preparing the Master Plan
- (b) Conduct workshops

1.3 The Study Area

The Study Area, as indicated in the location map, covers the six districts (Mymensingh, Tangail, Sherpur, Jamalpur, Netrakona and Kishoreganj) of the Greater Mymensingh area. The Study Area is located in the north-central part of the country bordered by the Meghna River in the east, Gazipur District and Dhaka City in the south, the Jamuna River in the west, and the Indian state of Meghalaya in the north. The Old Brahmaputra River runs through the Area flowing from the northwest to the southeast. In the southern part of the Study Area, the Madhupur terrace with an elevation of about 15 m lies in the 3 m-lowlands. The Study Area occupies 11.3 % of the country with a land area of 16,672 km², and has a population of 12.6 % (15.5 million people) of the total population (BBS, 2001). The local administration in the Study Area comprises of 6 Districts, 58 Upazilas (sub-districts) and 562 Unions.

1.4 Counterparts of the Study

As stated in S/W, the GOB counterpart institution is Integrated Water Resources Management Units (IWRMU) of Local Government Engineering Department (LGED) under the Ministry of Local Government, Rural Development and Cooperatives (MLGRD&C).

The counterparts of the Study are consisting of the staff of LGED headquarters and Executive Engineers and Upazila Engineers at the local government institution in the Study Area.

1.5 Surveys and Workshops conducted in the Study

The Study designed as participatory plan formulation with several workshops and meetings, and several surveys at each level of the administration. They are summarized as follows:

Stages	Workshops/Surveys	IMC	National	District	Upazila	Union	Community
Phase I: Problem Identification	W/S on the Inception Report and PCM Problem Analysis						
	Socio-economic Interview Survey						
	Farm Household Interview Survey						
	Union Questionnaire Survey(UQS)						
	W/S on Phase I Survey Results						
	W/S on Interim Report						
Phase II: Development Potential and Master Plan Formulation	W/S on Planned Field Survey & Questionnaire Survey to Upazila Engineers						
	Participatory Workshops (PRA)						
	Inventory Survey						
	UQS Verification Survey						
	CM of UDCC/DSSWRDC on Master Plan Concepts and verification of potential subproject						
	Explanation on Master Plan Concepts and verified of Potential Subproject						
	W/S on Draft Master Plan Explanation and Discussion						

Notes: W/S= Workshop(s), PCM=Project Cycle Management, UQS= Union Questionnaire Survey, PRA= Participatory Rural Appraisal, CM= Consultation Meeting(s), UDCC= Upazila Development Coordination Committee(s), DSSWRDC= District Small Scale Water Resources Development Committee, IMCC= Inter-ministerial Coordination Committee, = main targeted group, =secondary targeted group

Chapter 2 Tangail District

2.1 General Conditions

Tangail District (the District) with an area of 3,414 km², lies between 24°01' and 24°47' North latitudes and between 89°44' and 90°18' East longitudes, and it is bounded by Jamalpur district on the north, Dhaka and Manikganj districts on the south, Mymensingh and Gazipur districts on the east, Sirajganj district on the west.

Tangail subdivision was established in 1870 and was turned into a district in 1969. The District consists of 11 upazilas, 8 municipalities, 103 union parishads, 2,431 villages. The upazilas and their area are shown in table below.

Upazila-wise Area in km²

Name of Upazila	Effective area	Riverine area	Forest area	Total area	% over District
District Total	2 893.72	86.73	433.93	3 414.38	100.00
Basail	156.25	1.53	0	157.78	4.62
Bhuapur	212.95	12.07	0	225.02	6.59
Delduar	183.27	1.27	0	184.54	5.41
Ghatail	352.72	1.06	97.52	451.30	13.22
Gopalpur	191.82	1.55	0	193.37	5.66
Kalihati	290.01	3.21	0	301.22	8.82
Madhupur	346.49	0	154.18	500.67	14.66
Mirzapur	346.63	7.04	20.22	373.89	10.95
Nagarapur	234.21	28.49	0	262.70	7.70
Sakhipur	267.62	0	162.01	429.63	12.58
Tangail Sadar	303.75	30.51	0	334.26	9.79

Source: Census of Agriculture 1996

2.2 Natural Conditions

The climate of the District is moderate. Average temperature continues to rise uniformly from February and reaches the maximum in April at around 36°C. The minimum temperature is usually recorded in January which is 11.8°C. Mean relative humidity is high throughout the year and does not fall below 65%. The average annual humidity is 80%. The monsoon commences from June and continues till October. The average annual rainfall at Atia (Tangail) is recorded 2,014 mm, 68% of it concentrated in monsoon season (June - September) and only 3.7% of the annual rainfall in dry season (December to March).

The District belongs to the Northwestern part of North Central Hydrological Zone. The rivers flowing through the District are the Jamuna, Dhaleswari, Louhaganj, Bangshi and Jhena rivers. The Jamuna which is one of the most forceful rivers in the country flows along the western border of the District and joins the Ganges. The Dhaleswari and the Louhaganj rivers take off from the mighty Jamuna. The two tributaries of the Old Brahmaputra, the Bansi and the Lakha rivers join each other at Lakpur and their combined course passes through the eastern border of the District (Fig. 2.2). Most of them are non-tidal and navigable throughout the year. The linear length of all the rivers flowing over the District is about 198 kms covering an area of about 86.73 km². It occupies about 2.54% of total area of the District.

The northwestern part of the District is mostly occupied by the Madhupur Tract. The south-west region is occupied by the Jamuna floodplain and south-east region, by the Brahmaputra floodplain. The floodplain deposits are mainly silty on the ridges and clay in the basins. The soil in the Brahmaputra floodplain is generally well-structured and looks dark grey in color. In the Jamuna floodplain it is silty and sandy alluvium of grey loam.

Arsenic contamination of groundwater in the District is not so serious compare with districts in haor area of the Study Area.

2.3 Socio-economic Conditions

Population of the district is 3.25 million; male 50.02%, female 49.98%; Muslim 91.52%, Hindu 7.86%, Christian 0.40%, others 0.22%; Garo, Banshi and Koch are noted ethnic. Main occupations are; agriculture 49.53%, fishing 1.05%, agricultural laborer 17.28%, wage laborer 2.53%, weaving 1.68%, industry 1.71%, commerce 9.56%, transport 2.14%, service 6.67%, others 7.85%.

Average literacy rate of the District is 29.6%; male 36.1%, female 22.4%. Educational institutions are; science and technology university 1, university college 3, law college 1, homeopathy college 1, government college 4, non-government college 48, polytechnic institution 1, medical assistant training school 1, government high school 4, non-government high school 341, primary education training institute 1, satellite school 86, nursing institute 2, police academy 1, madrasa 174, junior school 40, government primary school 937, non-government 395, teachers' training school 1, community primary school 145, NGO operated school 1,304.

GDP of the District at current market prices in 1999-2000 is estimated at Tk. 47,986 million with growth rate at 4.81 %, and per capita GDP is US\$ 264 (or Tk. 13,297) which ranked the 56th among 64 districts in Bangladesh. Sectorial shares of GDP are; 31.0 % by crops & horticulture, 11.5 % by Fishing, 11.4 % by wholesale & retail trade (1999-2000).

According to “Local Estimate of Poverty and Malnutrition in Bangladesh (BBS & WFP, 2004), the population ratio below the lower poverty line in the District is mostly low at 25% to 31% except Mirzapur and Delduar upazilas. Percentage of population with calories intake lower than 1,805 Kcal/capita/day is moderate to high (10 to 30%) in the District.

Communication facilities are; pucca roads 691 km, semi pucca roads 222 km and mud roads 7,062 km; embankment 86 km. Number of hats and bazzars are 205; the most noted hats and bazzars are, most noted of which are Balla, Pakulia, Nalin, Alenga, Hamidpur, Gopalpur, Lauhati, Shialkol, Mirzapur, Baro Choana, Karatia, Bazidpur and Rampu.

Health centers are; Hospital 6, upazila health complex 10, union health complex 59, school health clinic 1, TB clinic 1, and mother and child welfare centre 1.

2.4 Agriculture in the District

According to the DAE Annual Report 2000-2001, the total agriculture land is 328,160 ha; cultivable fallow land at 14,921 ha, seasonal fallow land 5,175 ha. Major cropping pattern is Boro – Fallow – T.Aman(21%), Boro –B.Aman – Fallow (13%), T.Aman – Mustard/Boro (9%).

The cropping pattern and area land holding of the District is as follows:

Land holding and use	No. of holding		Operated area	
	No.	%	ha	%
Total	561,241	100.0	243,991	100.00
Non farm holding	169,019	30.12	6,729	2.76
Small holding	329,577	84.03	120,244	50.68
Medium holding	56,971	14.53	90,272	38.05
Large holding	5,674	1.45	26,745	11.27

Source: Census of Agriculture, 1996

Cropping pattern	Area (ha)	Share of Total Area
Single cropped area	44,689	18.3 %
Double cropped area	138,416	56.7%
Triple cropped area	61,075	25.0%
Net cropped area	244,180	-
Cropping Intensity %	207 %	

Source: 2000-2001 Annual Report of DAE

As shown the above table, 84% of the farm house holdings belong to the small farm holdings with an area of less than 1 ha. The medium and the large farm holdings were 14.5% and 1.5% respectively in the District. In the Study Area 84.1% of the farm holdings belong to the small farm holdings. Comparison of the 1983-84 of holdings with the 1996 indicates that the non-farm holdings increased by 1.92 times during this period. The farm holdings increased by 1.27 times, much smaller than the non-farm holdings. The small farm holdings increased by 1.48 times. On the other hand, the medium farm holdings decreased to 0.76, and the large farm holdings decreased to 0.54.

The area in the district under rice cultivation less than average of the total Study Area, while the area under wheat cultivation is relatively large. But it has the largest share of cultivation of wheat and pulses among the districts. Considerably large areas under oil seeds were also seen in the district. The gross cropped area and the percentage of distribution of crops in the study area is shown below:

Distribution of Crops in the District and Study Area (%)

District	Gross Cropped Area (1,000 acre)	Aus	Aman	Boro	Rice Total	Wheat / maize	Potato	Vegetables	Spices	Pulses	Oil Seeds	Jute	Sugar Cane
Tangail	829	9.7	26.2	29.9	65.7	5.0	1.3	1.4	1.7	2.8	14.5	6.0	1.4
Study Area Average	-	12.9	31.7	32.6	77.3	4.2	1.4	1.2	2.5	1.3	5.4	5.5	0.8

Source: Census of Agriculture - 1996 (BBS)

Gross value-added of major crops in the District and Study Area is shown below.

Gross value-added of agriculture by District at constant Prices (2000-01)

(Unit: million Taka)

District	Crops	Animal farming	Forestry	Fishing	Total
Tangail	7,877	1,818	1,105	854	11,654
Bangladesh	287,664	59,470	36,996	120,020	504,150
<Share (%) in Agriculture>					
Tangail	67.6	15.6	9.5	7.3	100.0
Study Area Average	59.0	11.6	7.7	20.4	100.0
Bangladesh	57.1	11.8	7.3	23.8	100.0

Source: Statistical Yearbook of Bangladesh (2001)

By District, Jamalpur Tangail and Sherpur showed a high percentage in the crops, while Kishoreganj and Mymensingh were low. In animal farming, Tangail showed the highest share. Kishoreganj, By District Jamalpur and Tangail showed a high percentage in the crops, but Kishoreganj and Mymensingh were low in the crops. In animal farming, Tangail showed the highest share. Kishoreganj, Mymensingh and Netrakona indicated high percentages in Fishing.

2.5 Fisheries in the District

(1) Production of Fishery in Greater Mymensingh Area

Inland water fisheries of Bangladesh are divided into two types. One is Inland open-water (river & estuary, Sundarban, Beel, Kaptai Lake, flood land), and the other is Inland close-water (pond & ditch, Baor, shrimp (freshwater shrimp) & fish farm). However in Greater Mymensingh area, there is no estuary such as Kaptai Lake and Baor.

In the rainy season, a lot of young and old men and women in rural areas catch fish in the floodplain, public canal, river etc. In addition, backyard pond culture using the hole that has been dug when soil is taken for the construction of house, road etc., becomes active every year. Freshwater fish is an important source of animal protein accounting for around 60% of the total animal protein intake. Moreover, freshwater fish, both caught in public water and cultured, is also an important source of cash income.

The table below shows annual fisheries production from inland waters in six districts in 2002. Pond and shrimp farm are culture fisheries and others are capture fisheries. According to the table, Mymensingh District ranks first in terms of total catch. The second is Kishoreganj District, followed by Netrakona District. Since Mymensingh District is the center of the great Mymensingh area, and the Faculty of Fisheries of Bangladesh Agriculture University as well as Bangladesh Fisheries Research Institute are situated there, the fisheries activities are more active than five another districts. Production by shrimp farm is recorded only in Kishoreganj District.

Total Catch of Inland Water, 2002

(Unit: MT)

No.	District	River	Beel	Floodland	Pond	Shrimp farm	Total
1	Mymensingh	2,607	5,332	25,270	23,314		56,523
2	Kishoreganji	1,284	5,584	19,191	9,237	15.82	35,312
3	Netrakona	1,344	8,013	8,867	15,682		33,906
4	Tangail	1,032	1,456	9,341	5,605		17,434
5	Jamalpur	755	2,287	6,746	3,241		13,029
6	Sherpur	85	2,330	3,830	2,486		8,731
Total		7,107	25,002	73,245	59,565	15.82	164,935

Source, Fisheries Statistical Yearbook of Bangladesh (2002), Department of Fisheries

The table below shows the area, total catch and catch/ha from Beel in 2002. Kishoreganj District and Netrakona District are most productive in Beel fisheries. So far it is not known whether the high productivity in those two districts is due to abundance of fisheries resources or intensive fishing effort.

Area and fisheries production of Beels, 2002

District	Area of Beels(ha)	Total Catch(MT)	Catch(kg)/ha
Jamalpur	3,360	2,287	680.7
Kishoreganji	6,837	5,584	816.7
Mymensingh	7,346	5,332	725.8
Netrakona	8,355	8,013	959.1
Sherpur	3,508	2,330	664.2
Tangail	2,333	1,456	624.1
Total	31,739	25,002	4,470.6

Source, Fisheries Statistical Yearbook of Bangladesh (2002), Department of Fisheries

(2) Tangail District

The Jamuna River flows through the western part of Tangail District, and causes damages by the flood every year. The table below shows annual catches from various inland waters indicating the general tendency of production increase every year except for some decrease in the catch from the flood land recorded in 2001. The fishery industry in this District seems not to be very active because it accounts for only 2 % of Regional GDP. However, there are seven private hatcheries producing about 5,000 kg hatching/fry of fish a year, and also there are about 360 nurseries in the District.

Annual Catches from Inland Waters in the Tangail District (MT)

Location	1998	1999	2000	2001	2002
River	605	955	928	1,072	1,032
Beel	2,273	2,387	2,250	2,282	1,456
Floodland	3,533	5,034	7,002	5,917	9,341
Pond	4,341	4,913	5,902	5,301	5,605
Shrimp farm	-	-	-	-	-
Total	10,752	13,289	16,082	14,572	17,434

Source: Fisheries Statistical Yearbook of Bangladesh, DoF

The number, average catch and total catch of subsistence fisheries households in Tangail District shows that it is likely to become over-fishing if catch increases any further. Therefore, some measures to introduce fish culture will be needed.

2.6 Livestock in the District

Climatic and topographic conditions, especially the high temperature and high humidity and frequent flooding, are not suitable to domestic animals. Pasture lands are not abundantly available for cattle and goats. Recently water shortages and development of agricultural machinery have caused unfavorable conditions to water buffalos. Due to the low feed efficiency, it has been difficult to enhance livestock farming in Bangladesh under the low food self-sufficiency. From these reasons, livestock farming has not been a priority area in the past. However, livestock is necessary to be developed in the future as an important income source of farmers. Livestock can be a demand-driven product. As the national economy develops, consumption of livestock will be increased.

Number of livestock in the District and Study Area by the size of holdings is shown below.

Number of Livestock in the District and Study Area

Number in 1000s

	Districts	Holdings		Farm Holdings			
		All	Non-farm	Total	Small	Medium	Large
Cattle	Tangail	638	33	604	402	175	28
	Study Area Total	2,526	156	2,370	1,493	724	152
Goats	Tangail	309	52	256	190	56	10
	Study Area Total	1,351	260	1,091	805	244	42
Fowls	Tangail	2,362	488	2,180	1,643	465	72
	Study Area Total	10,346	2,070	8,311	6,088	1,896	328

Source: Census of Agriculture - 1996 (BBS)

Percentages of households raising animals were particularly high in medium and large farmers (83% and 88% respectively). However, the rate within small farmers also indicated some 51% which is also not low. This indicates that farming is closely related with animal husbandry, and recycling and scavenging of livestock are well functioned. Difference in the number by district in the Study Area was not large in cattle. The high water level during rainy seasons is suitable for water animals and brings about high value. In the scavenging livestock, farming area of the farm lands has large effects on number of animals.

Land limitation causes a shortage of feed supply in Bangladesh. Various chars along large rivers such as the Jamuna River and the old Brahmaputra River are expected to be good pasturing areas. For that purpose, the water management of the rivers is important.

In Bangladesh, veterinary services are key issues for the development of livestock farming. According to the officers in Ministry of Livestock and Fisheries, the veterinary services in the Greater Mymensingh are not much different among the districts. Vaccination to poultry is already well organized. However, vaccination services to cattle and ducks are not well managed. Veterinary services in Kishoreganj and Netrakona, where duck farming are widely extended, need to be improved.

2.7 Zoning of the District

Based on the Agroecological Zone (AEZ) and inundation land type, upazilas in the District is mainly classified as 1) medium highland of Young Brahmaputra and Jamuna Floodplain, and 2) highland of Madhupur Tract (Fig. 2.3). Development strategies of these major zone areas are shown in Table 5.1 and shares of zones in the Upazila and union-wise classifications are shown in the table below:

(unit in ha)

Upazila		Active Jamuna Floodplain(7)	Young Jamuna Floodplain (802)	Old Brahmaputra Floodplain (902, 903)		Madhupur Tract (2801)	Total
		F1	F1	F1	F2	F0	
Basail	Total	0	5,301	0	10,094	0	15,395
	Share	0.0%	34.4%	0.0%	65.6%	0.0%	100.0%
Bhuapur	Total	7,842	10,686	0	0	0	18,528
	Share	42.3%	57.7%	0.0%	0.0%	0.0%	100.0%
Delduar	Total	7	17,107	0	0	0	17,114
	Share	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
Ghatail	Total	0	7,030	14,322	721	23,374	45,449
	Share	0.0%	15.5%	31.5%	1.6%	51.4%	100.0%
Gopalpur	Total	0	15,883	2,926	0	0	18,808
	Share	0.0%	84.4%	15.6%	0.0%	0.0%	100.0%
Kalihati	Total	2,403	17,806	2,084	6,147	269	28,709
	Share	8.4%	62.0%	7.3%	21.4%	0.9%	100.0%
Madhupur	Total	0	5,814	16,278	0	27,108	49,199
	Share	0.0%	11.8%	33.1%	0.0%	55.1%	100.0%
Mirzapur	Total	0	21,462	0	1,856	13,495	36,812
	Share	0.0%	58.3%	0.0%	5.0%	36.7%	100.0%
Nagarpur	Total	4,007	20,758	0	0	0	24,765
	Share	16.2%	83.8%	0.0%	0.0%	0.0%	100.0%
Sakhipur	Total	0	0	630	2,713	39,943	43,286
	Share	0.0%	0.0%	1.5%	6.3%	92.3%	100.0%
Tangail Sadar	Total	10,525	16,990	0	0	0	27,515
	Share	38.3%	61.7%	0.0%	0.0%	0.0%	100.0%
District	Total	24,784	138,837	36,240	21,531	104,189	325,580
	Share	7.6%	42.6%	11.1%	6.6%	32.0%	100.0%

2.8 Water Resources Development

(1) Hydrological Region and NWMP

The Study Area is covered by North East or North Central Hydrological Region. The District is under the North Central Hydrological Region. According to the National Water Resources Management Program, there is no specific regional water resources program except national level program for the Study Area. The FAP study in relation to the District is FAP 3: North Central Regional Study (NCRS). The FAP 3 Study Area is 12,000 km² lying between Jamuna, Padma, Meghna, old Brahmaputra and Lakhya rivers. The objective of the Study was to formulate a Regional Water Resources Development Plan (RWRDP) with emphasis on flood control and drainage. In the Development Plan, the region was divided into 13 Planning Units (PUs) based on hydrology, soils, land use, population density and socio-economic characteristics. After considering the main physical development constraints, PUs 1, 2, 4, 6, 7 and 10 were selected as priority development areas. Pre-Feasibility Studies were carried out on 6 Regional Schemes (RS), the scheme covering the District are as follows:

- Jamalpur to Bhuapur Development Scheme (RS2) in PUs 2 & 4 covering area of 149,000 ha (116,000 ha Net Cultivable Area, NCA)
- Dhaleswari-Kaliganga Development Scheme (RS3) in PUs 6a & 7 covering area of 150,000 ha (117,000 NCA)
- Bangshi River Improvement and Drainage Scheme (RS4) consisting of river widening, deepening and widening for a total length of 81 km
- Bhuapur-Aricha Development Scheme (RS6) is an alternative to RS3

(2) Large Scale Water Resources Development Projects

Among the large scale water resources constructed by BWDB, major information in the District is as follows:

- 1) Bailgana Khal Project (No.48) and Kamarnaogaon Project are useful projects.
- 2) Desilting of Nangli River Project (not listed) is on-going project.
- 3) Many other projects are under-going to obtain the approval by the Government.
- 4) FAP 20 Compartmentalization Pilot Project (CPP): The goal of CPP was to test the technical and economic viability of the compartmentalization concept, in which an area enclosed by an embankment would be provided with a comprehensive water control system designed and operated in order to provide a more secure environment for intensive agriculture, fisheries and integrated rural and urban development. CPP is located in Tangail on the left bank of the Brahmaputra (Jamuna) river, some 80 km north of Dhaka. It encompasses 13,305 ha of which around 9,858 ha is cultivable land. Implementation period of the project is 1991-1992 to 1999-2000. The project area is protected by 47 km flood embankment.

According to the NWRD of WARPO, there are 12 large scale water resources development projects, which were constructed by BWDB(Fig. 2.2). Its outline is summarized as follows:

Name of Project	Length of Embankment (km)	Length of canal (km)	No. of Regulator/Sluice Gate	New Type of System	Project Area (ha)	Irrigable Area (ha)	Starting Year	Completion Year	Status
Katakali Sub- Project	0.00	0.00	1	FCDI	2,662	1,110	1981	1983	Complete
Pigna Jokerchar Project	36.50	10.00	7	FCD	11,821	0	1983	1988	Complete
Pathakali Konaibeel And Bhulua Khal Project	23.34	5.00	2	FCDI	4,127	405	1978	1983	Complete
Noa Khal Sub-Project	0.00	0.00	2	FCD	1,024	0	1981	1983	Complete
Bailgana Khal Project	9.08	10.36	2	FCDI	4,896	1,000	1982	1992	Complete
Barkati Beel Project	2.55	9.66	1	FCD	314	0	1981	1986	Complete
Charan And Laxshmibasha Beel And Sapai River Project	45.24	16.76	3	FCDI	4,230	700	1982	1983	Complete
Futa Nadi Project	0.00	22.03	1	DR	1,200	0	1980	1981	Complete
Kamarnaogaon Project	21.14	4.82	3	FCD	6,200	0	1988	1991	Complete
Jhony Khal Sub-Project	7.90	3.95	3	FCDI	1,796	1,500	1980	1993	Complete
Babupur Lauhati Fcd Project	20.69	7.62	1	FCD	4,100	0	1990	1992	Complete
Moshajan- Lauhajan Sub Project	0.00	17.00	2	FCD	2,024	0	1985	1986	Complete

Source: National Water Resources GIS Data Base (NWRDB)

(3) Minor Irrigation Development

Minor irrigation equipment and irrigated area during Boro 2003 in the Upazila is show as follows:

Upazila	DTW		STW		LLP		Total Irrigated (ha)
	Numbers.	Area (ha)	Numbers.	Area (ha)	Numbers.	Area (ha)	
Tangail Sadar	66	1,246	3,505	8,066	10	31	9,342
Basail	39	589	2,775	6,242	10	26	6,857
Mirzapur	210	3,674	4,040	9,329	61	510	13,513
Sakhipur	304	5,570	2,020	6,460	60	420	12,450
Madhupur	72	1,828	5,501	15,936	15	132	17,896
Nagurpur	11	126	3,629	9,345	7	43	9,519
Delduar	63	996	2,303	5,213	8	35	6,248
Kalohati	73	3,354	4,079	13,522	58	247	17,128
Bhuapur	25	1,025	1,458	5,809	0	0	6,839
Gatail	80	1,755	4,505	12,508	125	720	14,983
Gupalpur	27	613	3,444	9,632	0	0	10,245
Total	970	20,775	37,259	102,062	354	2,164	125,019
Study Area	4,930	106,650	156,497	441,009	8,068	79,708	631,268

Sources: Survey Report on irrigation Equipment and irrigated Area 2003, BADC, Total irrigated area including the area irrigated by other traditional equipment

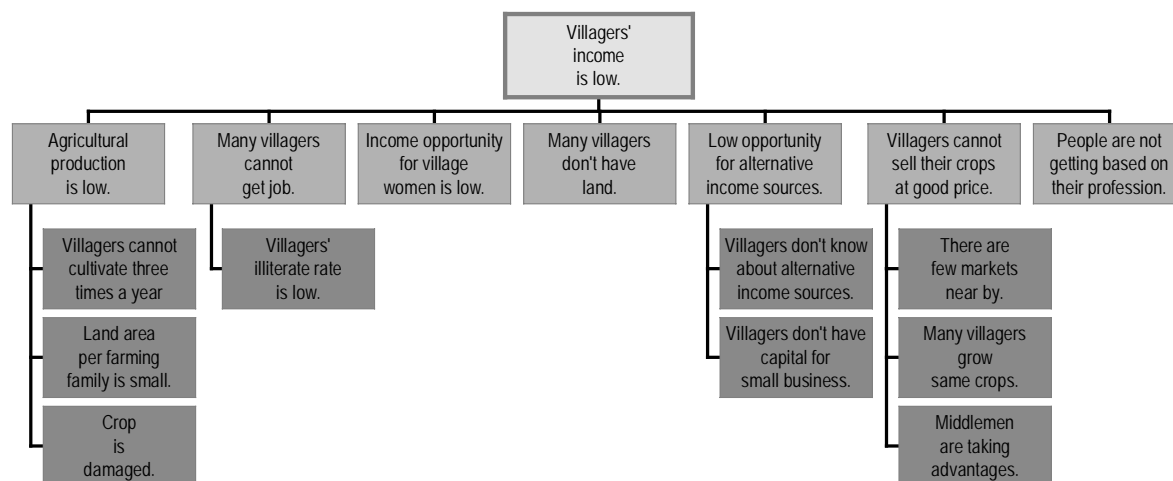
Chapter 3 Problem Analysis and Participatory Workshops in the District

3.1 Problem Identified through the Workshops in the District

To clarify the main issues concerning water resources management and livelihood in the Study, three (3) workshops were held at district, Nagbari Union of Kalihati Upazila and Rasulpur union of Ghatail Upazila in the District. Problem analyses were carried out in each workshop.

(1) Problem Identification Workshops of District Officials

Workshops targeting government officials were held at district levels. Participants were LGED officials/officers, government district agencies and representative of Union *Parishads*. Results are shown in the following problem trees.



(2) Problem Identification Workshops of Villagers in Subproject Areas

Workshops at Nagbari Union of Kalihati Upazila and Rasulpur union of Ghatail Upazila were held at 2 unions 9 and 10 Sep 2004. Selection of the workshop sites was done based on the zoning of the Upazilas. Problem trees are shown in Fig. 3.1.

(3) Summary of the Problem Analysis Workshops

Problem analyses were undertaken at each workshop with the core problem defined as “villager’s income is low”. Direct causes in each workshop are shown below.

Name of District/Upazila/Union	Tangail District	Nagbari Union, Kalihati Upazila	Rasulpur union, Ghatail Upazila
Direct Cause 1.	Low agri. Production	1. Low agri. Production	1. Can't market products
Direct Cause 2.	No jobs / work	2. No jobs / work	2. Low agri. Production
Direct Cause 3.	Landless	3. Low fish production	3. No jobs / work
Direct Cause 4.	Low price of products	Expenditure is large	Women can't earn.
Direct Cause 5.		Can't do livestock in flood	Expenditure is large

The direct causes identified as the least common multiplier of all the problems identified together with workshops in the Study Area are: 1) Low agricultural production, 2) Limited work opportunity, 3) Low profit from products, 4) Low fish production, 5) Large family expenditure, and 6) Women cannot earn, low livestock production, etc. (Fig. 3.2).

3.2 Problems and Issues Identified

(1) Problems identified in the District

Problems for small scale water resources development identified in the District are summarized in the following table

Problems related to Natural conditions:		
- Flat low lying terrain	- Strong Seasonal Bias of Rainfall	
Problems related to Socio-economic Conditions:		
- Poverty/Vulnerability of Farmers	- Gender Issues	- Local Conflicts
- Illegal Land Occupation	- Fragmented Agricultural Area and Small Landholdings	
- Communication Gap between Local Government and Villagers		
Problems related to agriculture, livestock and fisheries:		
(Agriculture)		
- Land development	- Water Related Problems	- Rice Monoculture
- Problems of deficit farmers	- Seed Production and Supply	- Traditional Farming
- Malnutrition by poor protein supply		
(Fisheries)		
- Flood damages	- Shortage of water during dry season	- Lack of freezing storage
- Insufficient fishery extension services	- No management of indigenous fish and conservation area	
- Hard to access for water bodies leasing by poor fishermen		
(Livestock)		
- Feed shortages in dry seasons	- Integrated forestry-livestock farming	- Veterinary services
(Marketing)		
- Poor marketing environment		
Rural Infrastructure Conditions:		
- Damages to roads	- Rural Community Water Supply	- Poor road network

(2) Findings of Farm Household Interview Survey and Union Questionnaire Survey

The survey was conducted to understand/identify profitable farming style. According to the results of farmers' interview survey, farmers expressing their request to the Union Parishads are summarized in the table. As far as water resources concerned, irrigation and drainage problems are expressed by farmers.

Priority of Farmers Requests to Union

Requests	Tangail	Average
Transportation (Marketing)	1	1.2
Sanitary facilities	2	1.7
Irrigation	3	3.0
Seed supply	5	4.5
Drainage	5	4.8
Health services	5	5.2
Fertilizer supply	4	5.5
Training for new technologies	8	7.2
Credit services.	8	8.7
Information services	10	9.5
Cooperative services	10	9.8

Source: JICA Farm household survey (2004)

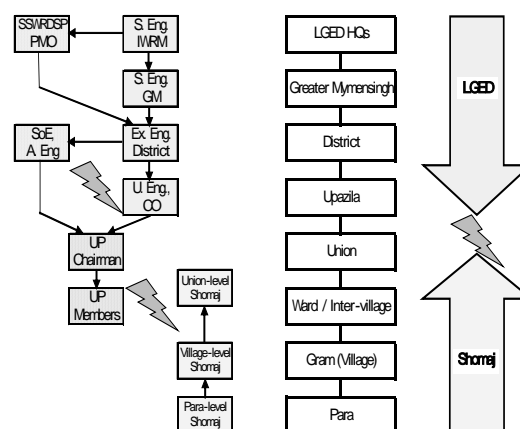
(3) Other Issues

1) PRA used in SSWRDSP-2

The PRA used in SSWRDSP-2 is a step of a project appraisal process by SSWRDSP-2. Therefore, PRA starts from the proposed project, not from the needs of the villagers or their future image. However, PRA workshops become the venue to talk about the development of the area, to get better consensus among stakeholders and improve subproject design.

2) Communication Gap

There found two major communication gaps in subproject planning, one between Union level and village/*para* level, and the other between project employee and LGED employee line. The former gap hinders getting the consensus of the people and establishing participation and ownership of the people. The latter gap hinders identifying and designing a good subproject. In this context, more participation of Upazila Engineer and Community Organizer to design-discussion meeting seems to be necessary. Also, consensus of *shomaj* elders at village-level and *para*-level should be reached before finalizing the proposal of subproject.



Communication Gap

3.3 Participatory Workshop (PRA) for Sustainable Water Resources Management

(1) Methodology

1) Issues:

Two communication gaps; one between union level and *gram* (village) / *para* level, and the other between project employee and LGED employee line.

2) Assumptions

Organizing several participatory workshops (PRA) at *gram* level beside sub-project level, with active participation of villagers, local leaders, UEs, AEs (SP-2), SoEs (SP-2), SAEs (SP-2) and other local LGED staff, can conquer these communication gaps and promote better project design and better consensus among all the actors.

The Team requested AE (SP-2) and/or SoE (SP-2) of each district to choose one promising sub-project area to organize participatory workshops.

➤ Benefits for the Study Team / LGED

To collect more grass-roots information especially on decision-making and collaboration in the community-base projects and activities.

To clarify the needs of the community

To verify a participatory planning and decision making process for small-scale water resources development including involvement of UEs, AEs (SP-2), SoEs (SP-2), SAEs (SP-2) and other local LGED Staff.

➤ Expected benefits for the local communities as a by-product

To share the ideas and opinions at intra-*gram*, inter-*gram* and sub-project levels.

To start some collaborative actions for consensus and for the future.

Capacity building of the individuals and the communities.

(2) Process of Participatory Workshops (PRA)

1) Arrangement of workshops with local leaders

Preparation of about four *gram* level workshops to strategically cover all the study area.

Preparation of one integrated workshop at sub-project level for summary and some consensus building.

Miking by UP Chairpersons, UP Members, *matabbors* and other local leaders for participation.

2) *Gram* level interviews and workshops

Interviews focused on poor villagers.

Mapping, rich-poor profile and other RRA tools if necessary.

Appreciative Inquiry : a) Discovery Stage by sharing success stories of community- based projects and activities, b) Dream Stage by sharing the future image of individuals and the community where they can repeat more success stories, c) Design Stage by sharing what actions they can take today, tomorrow and next week.

3) Integrated workshops

Presentation of the results of the *gram* level workshops.

Presentation of observation and analysis by the Team: identification of intra-*gram* / inter-*gram* issues, and sub-project / *upazila* / district level issues if any.

Discussion especially on inter-*gram* and sub-project level issues, and on immediate actions.

Interviews and Participatory Workshops Schedule at Each Subproject Area

1 st – 3 rd day:	Meeting with key persons and arrangement of workshops by the Study Team, transect of the study area and interviews of villagers by the PRA Contractor.
4 th – 7 th day:	Four <i>gram</i> level workshops (three <i>para</i> level workshops at the sub-project area in <i>Sherpur</i> District) using mapping, rich-poor profile and <i>Appreciative Inquiry</i> .
8 th day:	An integrated workshop at sub-project level: <ul style="list-style-type: none"> - Presentation of the results of the four <i>gram</i> level workshops by villagers - Presentation of the observation and analysis by the Study Team and the PRA Contractor - Technical issues of the proposed sub-project by UE and/or AE (SP-2) or SA (SP-2) - Social issues and WMCA by SoE (SP-2) - Question & answer, and free discussion
9 th – 10 th day:	Reporting by the PRA Contractor.

(3) Records of Participatory Workshops (PRA) in The District

Sub-project Name: <i>Nikla-Gabira-Ghungree-Amaldaha</i> Sub-Project	Grams: 1) <i>Amula</i> , 2) <i>Dighikatuli</i> , 3) <i>Bilamula</i> , 4) <i>Chanamula</i> , 5) <i>Nikla-Gopal</i> , 6) <i>Nikla-Gobardhan</i> , 7) <i>Anarkhpara</i> and 8) <i>Changthapara</i>	Appraisal Status: Under preparation (UDCC passed by the former proposal).
District: <i>Tangail</i>		
Upazila: <i>Bhuapur</i>		
Union: <i>Alowa</i>		
Type / Project Area (Benefited Area): Flood management and drainage improvement / 950 ha (600 ha).		
Major Proposed Activities / Facilities: Re-excavation of three canals and construction of an embankment and a sluice gate.		
Necessary Modification: Outlet canals need to be included in the sub-project. Inlet canals and <i>beels</i> might need to be included too.		
Summary of Participatory Workshops <ol style="list-style-type: none"> 1) Some villagers claim that the canal goes through their private land. They said their land was registered long time ago and they voluntarily contributed the land for canalization when it was originally made. They said they cannot give up their land now because population has increased and the land has become very scarce. 2) The UP Chairperson, who is the wife of the late UP Chairperson, admitted that she has never visited the ward and met the matabbors. 3) There is no doubt that the sub-project needs to include re-excavation of the downstream canals and it might become three-union three-upazila rather than one-union one-upazila sub-project. 		

(4) Some Cross Sectional Analysis

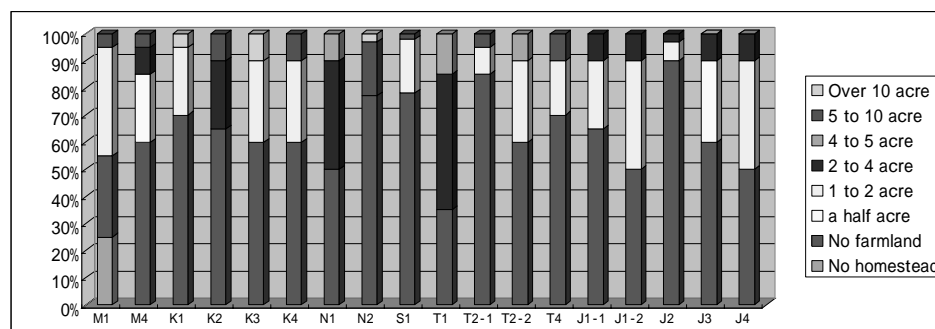
1) Rich-poor profiles at the *gram* level workshop

- 18 Rich-poor profiles conducted at the *gram* level workshops show that villagers define landless farmers as poor and the ratio of the poor ranges from 50% to 85% except in the workshop at *Amula Dhakhjl Madrasa* in *Alowa* Union, *Bhuapur Upazila*, *Tangail* District (T1), where the poor is only 35% and the rest (65%) of the villagers own more than one acre.

Rich-Poor Profile at *Gram* Level Workshops

	M1	M4	K1	K2	K3	K4	N1	N2	S1	T1	T2-1	T2-2	T4	J1-1	J1-2	J2	J3	J4
No homestead	25%																	
No farmland	30%	60%	70%	65%	60%	60%	50%	77%	78%	35%	85%	60%	70%	65%	50%	90%	60%	50%
a half acre		25%																
1 to 2 acre	40%		25%		30%	30%			20%		10%	30%	20%	25%	40%	7%		40%
2 to 4 acre		10%		25%			40%			50%				10%	10%		10%	
4 to 5 acre							10%			15%		10%						
5 to 10 acre	5%	5%		10%		10%		20%	2%		5%		10%					
Over 10 acre			5%		10%			3%										

- The ratios of the poor vary from 35% to 85% in the subproject area of *Tangail* and 50% to 90% in a subproject area in *Jamalpur*, Social structure at *gram* level might be totally different even in a 1,000 ha area.



Note: Mymensingh (M1, M4), Kishoreganj (K1 to 4), Netorakona (N1, N2), Sherpur (S1), Tangail (T1, T2-1, T2-2, T4), Jamalpur (J1-1, J1-2, J2 to 4)

2) Cash income of relatively poor villagers

The PRA Consultant Team made 92 interviews in total, 15 or 16 interviews at each sub-project site. They did a purposeful sampling of interviewees by visiting rather small and shabby huts. 26 out of 92 interviewees or 28.3% are women, and strikingly, 14 out of 26 or 53.8% of the women are single (13 widows and one divorcee). At the sub-project area in *Kishoreganj*, all the four women interviewed are widows.

8 out of 26 female interviewees or 30.8% said they are doing maid and earn something like three meals and Tk. 30/day or 0.5 kg of rice per day to 1 mond (40kg) per month. 6 out of 26 or 23.1% are day laborer earning Tk. 30 to 100 and they are all in *Sherpur*. 5 out of 26, or 19.2% said they are hawkers of fishes, vegetables and household goods, and earn Tk. 25 to 60/day. Also another 5 said they are housewives.

32 out of 92 interviewees or 34.8% said their major income source is day labor and the daily wages range from Tk. 30 to 100/day. At the sub-project area in *Sherpur*, 14 out of 15 interviewees or 93.3% are engaged in day labor of farming, forestry and earthen work etc. One villager said he is a farmer with 50 decimal (0.5 acre) of farmland.

The daily wages and availability of farming labor vary from month to month. For example in *Jamalpur*, the wage is about Tk. 50/day in July-September, about Tk. 60/day in January-March, about Tk. 80/day in November-December, and about Tk. 100 in April-June. Usually one meal and 0.5 kg of rice are provided by the landowners in planting and weeding seasons, and two meals and 1 kg of rice in harvesting season.

9 out of 92 interviewees or 9.8% said they are share-croppers but their land sizes are something like one or two *bigha* (0.33 or 0.66 acre) and they do day labor substantially. 8 out of 92 interviewees or 8.7% are rickshaw/van pullers and earn Tk. 50 to 200/day. Some are working in Dhaka. 7 out of 92 interviewees or 7.6% are hawkers of fishes, vegetables, ice cream and household goods and earn Tk. 25 to 100 (Tk. 25 to 60 for women)/day.

In conclusion, options of day labor for women are less and wages are lower than men. Men can choose fishery or farm labor in high season, and rickshaw/van pullers, earthen work or hawkers in low season. Many of them can still make Tk. 50-70 per day all year round. Maximum wages women can make, however, is Tk. 60/day if earthen work is available. Only some women are lucky enough to find wood cutting / planting jobs or to be able to work in the field. Otherwise, to work as a maid might be the best regular occupation.

The majority of poor farmers (55 out of 92 interviewees or 59.8%, the cases with no interest are excluded) are borrowing money at very high interest (8% to 20% per month or 100% to 240% per year). 57.9% are the loans for food, agriculture, business etc. and the average amount is Tk. 1,873. 34.2% are for health problems and the average amount is Tk. 3,431. Others are for land and houses (Tk. 20,000 and Tk. 14,000 from NGOs), and for wedding (Tk. 7,800)

(5) Participatory Planning and Decision Making Process

COMMON ISSUES	POSSIBLE IMMEDIATE ACTION
On Project Designing	For Project Designing
1. All of the six sub-projects where the Team had workshops go beyond union borders. If the benefited area is close to 1,000 ha and the area of each union is something like 2,000-3,000 ha, the sub-project most likely is a multi-union project.	1. Assuming all the sub-projects are multi-union, UE, AE (SP-2), SoE (SP-2) and other local LGED Staff need to check all the sub-project proposals and rewrite them accordingly.
2. Negative impacts tend to occur near the border of the project area, especially beside the facilities such as embankment, sluice gates and culverts. They are not paid attention so that no mitigation measures can be taken, if appraisal teams only study inside of the project area.	2. The study area for the appraisal teams need to include potentially affected areas such as outside of embankment, outlets or inlets of sluice gates and culverts, and upstream of dams. The study area must be significantly wider than the project area.
3. Project purpose, major project facilities and activities are not so clear in the sub-project proposals, and they are being refined through "appraisal" process by the appraisal teams.	3. UEs, AEs (SP-2), SoE (SP-2) and other local LGED staff must refine the sub-project proposals so that the project purpose, major project facilities and activities are clear.
4. UEs, AEs (SP-2) and other local LGED staff are not involved in substantial project designing because it is considered as "appraisal" process.	4. Full and active participation of UEs, AEs (SP-2), SoE (SP-2) and other local LGED staff in project designing is a must. Participation does not only mean participation of the villagers, but of all the actors.
5 Phasing of the projects and priority in <i>upazila</i> / district development (plans) are not so clear.	5. UEs, AEs (SP-2) and other LGED staff at <i>Upazila</i> and District levels need to add comments to the sub-project proposals on phasing and priority in the <i>upazila</i> and the district.

COMMON ISSUES	POSSIBLE IMMEDIATE ACTION
On Consensus Building	For Consensus Building
1. Few districts or <i>upazilas</i> have full appraisal reports, so that local LGED staff cannot explain the results, either the proposals pass or fail, fully to UP Chairpersons and villagers.	1. For transparency and accountability to UP Chairpersons, UP members, local leaders and villagers, copies of all the appraisal reports must be sent to each district and the <i>upazila(s)</i> so that AEs (SP-2), SoE (SP-2), UEs and other local LGED staff can explain the results of appraisals to them.
2. Few UP Chairpersons consult <i>gram</i> level leaders, sometimes not even UP members, before submitting subproject proposals.	2. Accountability to the villagers and consensus of <i>gram</i> level leaders such as <i>matabbors</i> need to be the pre-requisites for UP Chairpersons to submit sub-project proposals
3. One transect walk and one workshop in a sub-project area are not enough for consultation. Important negative impacts and social conflicts can be unrecognized by the appraisal teams, and many questions of the villagers will be unanswered.	3. Two-day interviews and three to five <i>gram</i> level workshops need to be conducted in addition to one transect walk and one workshop by the PRA team. A workshop for more than three <i>grams</i> usually cannot attract so many ordinary villagers from all the <i>grams</i> . A workshop for every one or two <i>grams</i> is recommended.
4. Neighboring villagers of a sub-project do not have opportunities to be consulted by the appraisal teams	4. The villagers of neighboring <i>grams</i> and unions must be included to the interviews and workshops by the PRA team. They could be affected negatively by the proposed sub-project. The primary purpose of impact assessment is not to show there are little negative impacts, but to show how many mitigation measures are identified and how much project design has improved from the original one.
5. Many villagers do not have opportunities to get information on WMCA so that they do not know what WMCA is even after they have agreed to join WMA.	5. Full explanation to the villagers on major activities, pre-requisites and benefits of WMCA is necessary before asking about their promises to join WMA.

(6) WMA or WMCA

1) WMAs in SSWRDSP-1

There are 280 subprojects in SSWRDSP-1 and the average members of WMA are 413, of which 100 or 24.2% in average are female members. The members are largest at 833 (an average of four WMCAs) in Pabna District and smallest at 110 (an average of four WMCAs) in Bogra District.

The target amount of beneficiary contribution is Tk. 128,417 in average per WMA. The amount is highest at Tk. 363,342 (an average of six WMCAs) in Chapai Nawabganj District and lowest at Tk. 27,259 (an average of seven WMCAs) in Thakurgaon District.

The collected amount of beneficiary contribution is Tk. 290 per member in average. It is highest at Tk. 1,247 per member in Bogra District and lowest at Tk. 104 per member in Jhenaidah District.

2) Community-Based Projects

From the success stories of community-based projects, the Team has found that about 20 villagers invested for a gram level earthen dam project in *Sherpur* District about Tk. 240,000 every season for nine years. In case of a gram level DTW project in *Mymensingh*, 35 villagers invested Tk. 350,000. The amount is almost as much as the target amount of beneficiary contribution in *Chapai Nawabganj* District.

The water fee of the earthen dam project in *Sherpur* District is Tk. 800 per acre, and that of the DTW project in *Mymensingh* District is Tk. 140/Katha (Tk. 1,750 per acre). The investment, water fee, construction wages and who work as day laborer etc. were decided by *shomaj* of *matabbors* and villagers have had no serious problems of investment nor collecting water fees.

The interviews showed that more than 20% of the poorer households in the villages could be female-headed. Also more than half of the population is usually landless and poor. The figure could be as high as 90% in some *grams*.

Women have much less options and opportunities for cash income in the villages. If they are not lucky enough to be able to work in the forest or in the paddy field, the best they can do is to find temporary earthen work, work as a maid (usually 40kg of rice per month plus three meals) or as a hawker (could be Tk. 30-40/day).

3) RECOMMENDATION

It seems to be very difficult for poor families, especially female-headed families, to contribute Tk. 300, sometimes more than Tk.1,000 in cash to join WMCA. They might not be the direct beneficiaries of the subprojects either if they are landless. On the other hand, it is not difficult for villagers to invest Tk. 300,000 at gram level if they are community-based projects, the decision was made through *shomaj*, and landowners, who are more likely the real direct beneficiaries of subprojects, invest and pay the water fee. Therefore:

To exempt poor landless farmers, especially female-headed households, from cash contribution to join WMA.

To introduce progressive cash contribution system based on gram level decision.

To charge operation and maintenance fee solely on landowners' accounts.

To include community-based water resources development projects into WMAs under SSWRDSP-2 even if they are not selected as subprojects.

Chapter 4 Small Scale Water Resources Development Potentials

4.1 Surface Water Resources in the District

(1) Perennial/seasonal waterbodies

There are about 378 perennial waterbodies, with a total area of about 2,402 ha which cover 0.7% of the District. Among them, beels are counted as 73 (NWRD of WARPO) with an area of 8,606 ha in the District as shown in the following table. There is a upazila and 75 unions which as no beel in there administrative area; in other wards, only 27% of unions have beels in the District.

District	Total Numbers		No. having Beel		No. of Beel*	Beel Total Area (ha)
	Upazila	Union	Upazila	Union		
Tangail	11	103	10	28	73	8,606
Study Area Total	58	565	52	250	664	15,033

Source: NWRD, WARPO

Notes: * because a beel locates in the several unions

In regard to the water scarcity in dry season, it may be said that all waterbodies especially beels with considerable scale have some potential for SSWRD. Installation of supplemental water retention facilities or dredging may improve its utilization.

(2) Char Land

The Char lands are extending along the Jamuna River at the western border of the District. The rivers themselves flow in broad channels, which become a series of sand or silty islands or Chars at low water period, and are completely submerged during the wet season. The char lands may be regarded as the active flood plains in which the rivers are constantly changing courses.

Flood protection in such areas is clearly unpractical. However, agricultural production may be enhanced/stabilized by mitigating early flood damage and promoting post-monsoon drainage. In consideration of the development plan of both areas, the master plan study was conducted as “The Study for Rural Development forecasting on Flood Proofing” by JICA in 2002. The master plan set the strategies for minimal flood proofing measures as well as flood warning and evacuation system and a set of livelihood development. And the model projects are implemented at present.

(3) Flood water

While floods are the major constraints for livelihood in the District, it is also a fact that it is a source of water, and with an excessive amount. Retention and utilization of flood water for supplementary irrigation may enhance agricultural production particularly in areas with relatively high altitude.

4.2 Small Scale Water Resources Development in the District

(1) Previous SSWRD Program

There was not significant project operated in the District except Thana Irrigation Program (TIP) in 1960s and Canal Digging Program (CDP) since 1979 up to 1996, Also the SSWRDSP, started 1995, was implemented in the western part of Bangladesh. Since July 2002, the SSWRDSP-2 has started covering the District.

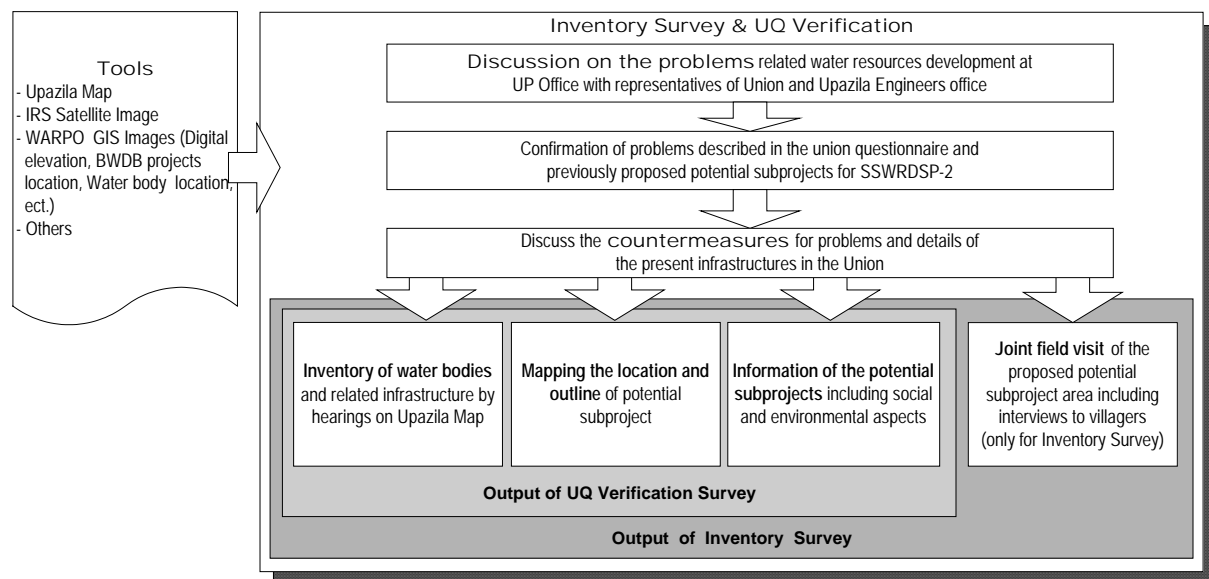
(2) Progress of SSWRDSP-2

There are 29 subprojects proposed from 20 unions of the District according to the information of SSWRDSP-2 PMO office as shown in Table 4.1. The subprojects proposals were screened by the following procedures: 1) prescreening at district level, 2) reconnaissance by PMO, 3) PRA/Pre-feasibility survey by local consultants, 4) Feasibility Study by consultant. Up to the reporting period, four (4) subprojects were granted approval for implementation. Most of reasons for failure at prescreening stage are incomplete format.

4.3 Identification of Potential Subprojects

(1) Methodology

Identification of potential SSWRD subproject was conducted by the inventory and union questionnaire verification surveys. Both surveys conducted firstly, discussion and clarification of the answer of union questionnaires on the water related problems in the Union among UP chairman and members, representative of villagers and staff of Upazila engineer's office at Union office. Then the locations, necessary countermeasures for the problems faced by people in the Union were confirmed. These scopes of works for the potential subprojects not only the technical aspects but also environmental and social aspects were discussed and recorded by surveyor and enumerator of the Study Team. In case of the inventory survey, the proposed potential subprojects were visited to confirm the present conditions and conduct the preliminary technical assessment including interviewing the potential beneficiaries by members discussed in the Union office. Processes of both surveys are shown below:



(3) Inventory Survey

1) Objectives

To examine the situation of water resources related infrastructure, confirm the contents of the collected Union Questionnaires and to identify the potential subprojects for SSWRD in selected 23 Unions of the District

2) Selection of Unions to be surveyed

Selection of unions to conduct the inventory survey was done based on the submission of subproject proposals for SSWRDSP-2. Unions, which were previously selected, based on the understanding that information on present water bodies and related infrastructure is required.

3) Survey Procedures

The survey was conducted by dispatching consultants to each Union and by conducting interviews to relevant government officers, UP chairmen and members, village heads, Upazila Engineers and other local stakeholders and actual field survey to the water resources infrastructures and potential subproject sites. The survey process for each union was as follows:

- a) Explanation of survey to relevant officers at Union complex
- b) Identification of water bodies / infrastructure location and access route
- c) Survey on water bodies / infrastructure
- d) Verification of information indicated in the Union Questionnaires
- e) Discussion with relevant officers at Union complex for identification of potential subproject areas and possible intervention plans based on identified water bodies/ infrastructure

(3) Union Questionnaire Verification Survey

1) Objective

To verify the contents of the collected Union Questionnaires and to identify/collect information relevant to potential subprojects for SSWRD in the 78 unions of the District, which were not selected for the Inventory Survey.

2) Survey Procedures

The Survey was done through interviews to local stakeholders including UP chairmen, members, village heads, Upazila Engineers and other local representatives.

(4) Identified Potential Subprojects

1) Results of Potential Subproject Identification Survey

In preparation of the list of potential subprojects for SSWRD in the District, the results of field surveys were carefully examined and necessary modification were made. Accordingly, the Study Team identified 130 ungrouped potential subprojects in the District. The identified potential subprojects were categorized into four types; 1) Flood Management: FM, 2) Drainage Improvement: DI, 3) Command Area Development: CAD and 4) Surface Water Conservation: WC, accordingly to their contents. The type, scale of gross area and relation with BWDB projects in the district are summarized in the following tables, while the locations of these subprojects are indicated in Fig. 4.1. These preliminary identified potential subprojects has further been screened to clarify whether they should be implemented under small-scale water resources development schemes, and then has been prioritized in order to select those for further implementation arrangements.

Identified Potential Subprojects by type

District	FM	DI	CAD	WC	FM& DI	FM & WC	DI& WC	FM, WC&DI	Total
Tangail	17	33	0	14	22	4	27	13	130
Study Area Total	118	145	2	67	83	25	185	69	694
% within total	17.0	20.9	0.3	9.7	12.0	3.6	26.7	9.9	100

Identified Potential Subprojects by Scale of Area

Upazila	Gross Subproject Area (ha)					BWDB Related
	1,000	1,000 < 1,500	1,500 < 2,000	> 2,000	Total	
Tangail	128	1	1	0	130	33
Study Area Total	572	57	18	47	694	176

2) Verification of Identified Potential Subprojects

After discussion in the UDCC, DSSWRC and IMCC, the identified subprojects were reviewed in the light of the comments received in these meetings. The hydrological features and contents of the identified subprojects were also examined to verify its adequacy as a single subproject. Consequently, a total of 120 potential subprojects were verified. About 9% of the potential subprojects were grouped in the District. This was mainly due to: 1) multiple upstream-downstream subprojects with contents of re-excavation continuously located on the same river/*khal*, and 2) multiple subprojects with continuous contents of embankment rehabilitation/construction.

Out of the 120 verified subprojects, 101 had gross areas of 1,000 ha or below. This counts up to some 84% of the total verified subprojects.

Verified Potential Subprojects by type

District	FM	DI	CAD	WC	FM& DI	FM & WC	DI& WC	FM,WC &DI	Total	Total before verification
Tangail	14	32	0	11	20	3	25	15	120	130
Study Area Total	91	101	2	57	80	23	157	82	593	694
% within total	15.3	17.0	0.3	9.6	13.5	3.9	26.5	13.8	100.0	-

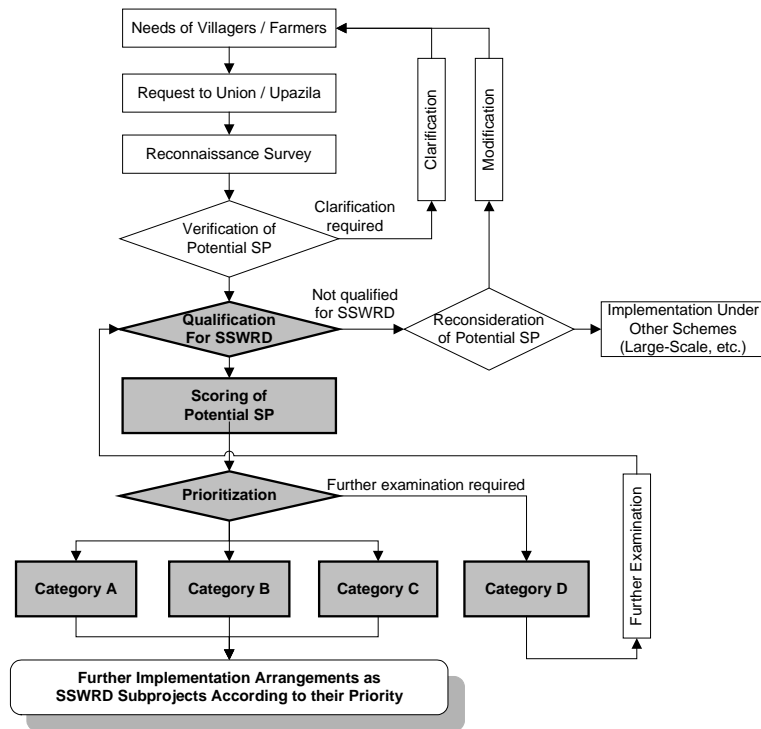
Verified Potential Subprojects by Scale of Area

District	Gross Subproject Area (ha)				Total	BWDB Related
	1,000	1,000 < 1,500	1,500 < 2,000	> 2,000		
Tangail	101	12	4	3	120	33
Study Area Total	473	63	24	33	593	170

4.4 Prioritization of Potential Subprojects

(1) Necessity of Prioritization

In order to effectively utilize limited inputs, development activities of the Master Plan should be implemented at the right place for the right purposes, contributing at the maximum extent to its overall goals. Prioritization of subprojects should be done with necessary criteria to select the most important interventions. Before prioritization, the verified subprojects which were obviously unqualified for SSWRDSP were screened out, and then the qualified potential subprojects were scored and categorized into four categories (A, B, C and D) depending on their scores and maturity in planning.



Flow of Prioritization

(2) Method of Prioritization

Identification of potential subprojects was done by first identifying the needs of the local villagers and then by formulating a package of measures to cope with these problems. This was done so that the measures to cope with the most important problems were not forced to take the form of SSWRD, neglecting the possibilities of other forms such as medium and large-scale interventions, which may be more suitable in certain cases. In this context, the verified subprojects were not necessarily designed as SSWRD subprojects from the beginning.

Among prioritization, the verified potential subprojects were pre-screened to exclude subprojects that clearly do not fit into the SSWRD scheme. For this process, the gross area and location of the verified subprojects were applied, where medium and large-scale subprojects as well as small-scale subprojects lying in areas protected for the purpose of environmental conservation were excluded.

After pre-screening, the qualified subprojects were scored by applying a method for multi-criteria analysis. The criteria and weight of the scores were carefully examined based on available information, and each qualified subproject was scored accordingly. The main items regarded in the criteria were: 1) Impact on Poverty Alleviation, 2) Significance of Benefit, 3) Hydrological and Environmental Considerations, and 4) Easiness of Implementation of the Subproject and O&M by Local Beneficiaries in the Subproject Area

Subsequently, the maturity of the qualified subprojects was checked based on the criteria developed under the SSWRDSP-2, which is the current scheme for implementation of SSWRD subprojects. Those found to require further examination for implementation as SSWRD subprojects were categorized as Priority D, while others were categorized into A, B and C according to their scores.

(3) Qualification of Verified Subprojects

1) Criteria for Qualification of Verified Subprojects

Under the NWPo, water resources development interventions with the benefiting are of 1,000 ha or less are categorized as “Small-Scale”. In this regard, all such interventions can be referred to as potential SSWRD subprojects. However, LGED has developed a set of selection criteria under the SSWRDSP-1 and 2 to qualify subprojects that are expected to be effective and efficient. This criterion covers a wide range of issues from economic viability / technical feasibility to social acceptability and environmental soundness.

In regard that the potential subprojects that are identified and prioritized under this study are to be implemented by LGED, and that the SSWRDSP-2 following its first phase is currently the only scheme under LGED to implement SSWRD subprojects, these criteria (or modified according to future needs) would be most appropriate in qualifying such potential subprojects.

However, in order to give concrete decisions on whether the potential subproject is fully qualified or not, analysis must be done in detail for each individual criteria. In regard that the Master Plan Study has not stepped in to the very details of the individual subprojects, but rather concentrated in collecting general but overall information to provide the directionality for SSWRD, it is not favorable to completely judge the potential subprojects at this stage, where those judged unqualified will be excluded from further examinations. In this regard, two fundamental criteria were applied for qualification (pre-screening) of the verified potential subprojects, while the remaining selection-criteria were considered later on for the prioritization of qualified subprojects.

The criteria applied were:

Gross subproject area: Based on the definition of SSWRD subprojects, the benefiting are of each subproject must be 1,000 ha or less. At this stage, detailed analysis of topography and hydrology is not done for individual subprojects, therefore, accurate figures of benefiting areas are not presented. Taking into regard that based on GIS analysis of the layout of verified subprojects, some 20% of the subprojects area is expected to be settlements, roads etc., qualification of the subprojects were done by adding 20% margin to the current frame. Also taking into regard that the range of benefiting area as defined in SSWRDSP-2 is 50 to 1,000 ha, verified subprojects with the gross area falling outside of the range of 60 to 1,200 ha were excluded.

Overlapping with protected areas : In order to prevent obvious negative impact on the environment, implementation of subprojects in protected areas should be avoided. In this regard, verified subprojects located in Madhupur National Park and its buffer zone as defined by the Department of Forestry was excluded.

2) Qualified potential subprojects

Through the process of pre-screening in regard to the criteria set above, some 19% of the verified subprojects were considered to be of large scale, while 1 was located within Madhupur National Park. As a result, 102 subprojects out of the 120 verified subprojects were found qualified. These qualified subprojects will be prioritized for further implementation arrangements. The average area of a single qualified subproject is 473 ha, ranging in the District. Out of the District, 14.1% will be under the gross subprojects area if all 102 subprojects are implemented.

District-wise Number and Area of Qualified Subprojects

District	Number of verified subprojects	Number of qualified subprojects	Total gross area of subprojects (ha)	Average gross area of subproject (ha)	Total area in the District (ha)	% of Total gross area within the District
Tangail	120	102	48,235	472.9	341,400	14.1
Total	593	496	266,743	537.8	1,667,200	16.0

Type-wise Number of Qualifies Subprojects

District	FM	DI	CAD	WC	FMDI	FMWC	DIWC	FMDI & WC	District Total
Tangail	13	28	0	11	18	3	17	12	102
Study Area Total by Type	81	89	2	52	70	21	118	63	496

(4) Prioritization of Qualified Potential Subprojects

1) Prioritization Method

After qualification, the potential subprojects were prioritized and categorized into four categories (A, B, C and D) according to their priority. This was done by two approaches. One to screen out and lower the priority of potential subprojects that are qualified but yet require additional information to confirm if they satisfy certain criteria for SSWRDSP-2. The other is to score the qualified subprojects by using a multi-criteria analysis method, and selecting those with higher priority based on a set of criteria. The potential subprojects selected in the former process was categorized into category D, while the remaining were categorized in to A, B, and C.

a) Screening of Category D Subprojects

Out of the set of selection criteria developed under SSWRDSP-2, two were applied in the process of qualifying the potential subprojects. The remaining criteria were not applied in consideration that the potential subprojects should not be completely screened at Master Plan level. However, based on the information collected in the study, preliminary judgment for the criteria concerning subproject construction cost can be made, where potential subprojects not satisfying the criteria at this point should be bound for further examination. In regard that such examination will require more time and resources, they should have lower priority among implementation. The potential subprojects not satisfying the criteria were categorized into “Category D”, which require further examination to clarify whether they can (with or without modification) satisfy the set of selected criteria.

SSWRDSP-2 Selection Criteria and its Application for Screening “D Category” Subprojects

SSWRDSP-2 Selection Criteria	Application	Reason
The SP must be in line with district strategies and guidelines for SSWR and approved by DIAPEC	Applied for qualification	The Master Plan itself is positioned as the district strategy for SSWRD. Approval of DIAPEC will be done at the stage of implementation
More than 40 % of the SP benefited area will be operated by landless share croppers, marginal farmers	Not applied	Examination should be done based on reliable information obtained at the stage of feasibility study
No more than 30 % of the households depend on subsistence capture fisheries.	Not applied	Examination should be done based on reliable information obtained at the stage of feasibility study
Each SP will entail rehabilitation / upgrading of an existing water control system	Not applied	Examination will be done at field reconnaissance
SP cost must not exceed \$ 1000/ha for CAD and \$ 500 for other schemes without ADB's prior approval.	Applied	Examination will be done by checking the contents of the potential SPs
Benefited area served by the SP must be more than 50 ha and not exceed 1000 ha.	Applied for qualification	Already applied for qualification of verified subprojects
Each subproject must be technically feasible; economically viable (EIRR > 12 %)	Not applied	Detailed study should be examined at the stage of feasibility study.
Capacity of beneficiaries in ensuring the sustainability of submersible embankments must be shown for Interventions in the deeply flooded part of the Northeast Region	Not applied	Detailed study should be examined at the stage of feasibility study
The SP shall be environmentally sound and IEE/EIA study has to be undertaken and appropriately approved after consulting the beneficiaries and project affected people	Partially applied for qualification	SP areas in environmentally sensitive areas have been taken into consideration
The SP shall be socially sound and require no or minimal displacement of people and land acquisition, and not involving sensitive areas	Not applied	Detailed study should be examined at the stage of PRA
Enrollment of 70 % of the direct beneficiary households as member of the WMA.	Not applied	Detailed study should be examined at the stage of PRA – WMA formulation
Recurrent cost of subproject O&M shall be covered by beneficiaries through formulated WMA	Not applied	Detailed study should be examined at the stage of PRA – WMA formulation

b) Scoring Method of Qualified Subprojects

Scoring of subprojects was done by applying *Analytical Hierarchy Process* (AHP) method, which is a tool for decision making with various parameters (multi-criteria analysis). During the last three decades, especially when the social or administrative and environmental or hydrological impacts have been emphasized in decision making process, traditional methodologies such as Cost-Benefit Analysis (CBA) or Cost-Utility Analysis (CUA) have been gradually replaced or complemented by Multi-Criteria Decision Methods (MCDM), with prominence for AHP. The main concept is to examine relative importance of various factors for decision-making using a matrix chart called a "decision-tree". Comparison of importance is examined by hierarchy by examining relations of two items and then integrating the relations into one matrix.

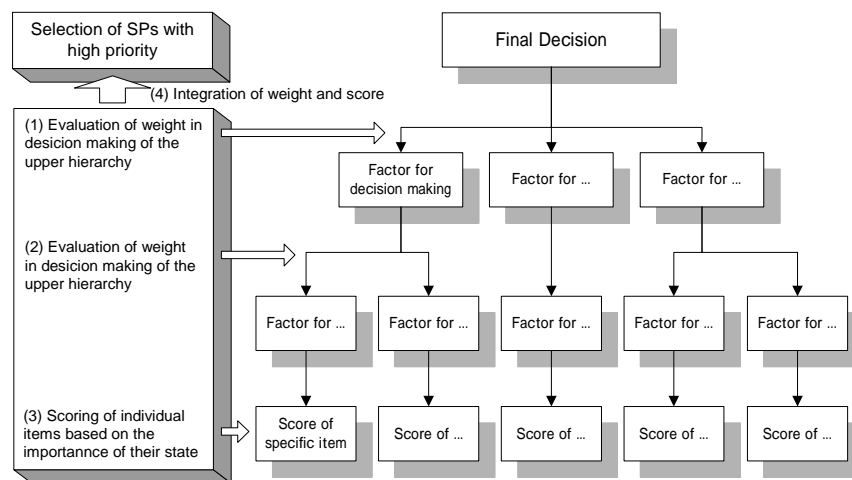
Relative importance of items/decision factor called "natural states" regarded for categorization of SPs was considered and weights for scoring of these items were examined. The main procedure consists of four steps.

- Examining weight of importance of each category
- Examining weight of importance of each item in the same category
- Scoring of individual items in consideration of each state
- Integration of individual scores and weight to prioritize potential subprojects

In scoring individual items, a pair-wise comparison matrix is formed reflecting relative importance of the items based on a nine-point Relative Importance Scale as shown in the right table.

Pair wise Comparison Scale

Relative Preference / Importance	Numerical Rating
Extremely preferred/important	9
Very strong to extremely	8
Very strongly preferred/important	7
Strongly to very strongly	6
Strongly preferred/important	5
Moderate to strongly	4
Moderately preferred/important	3
Equally to Moderately	2
Equally preferred/important	1



Process of Subprojects Prioritization

c) Criteria for Scoring

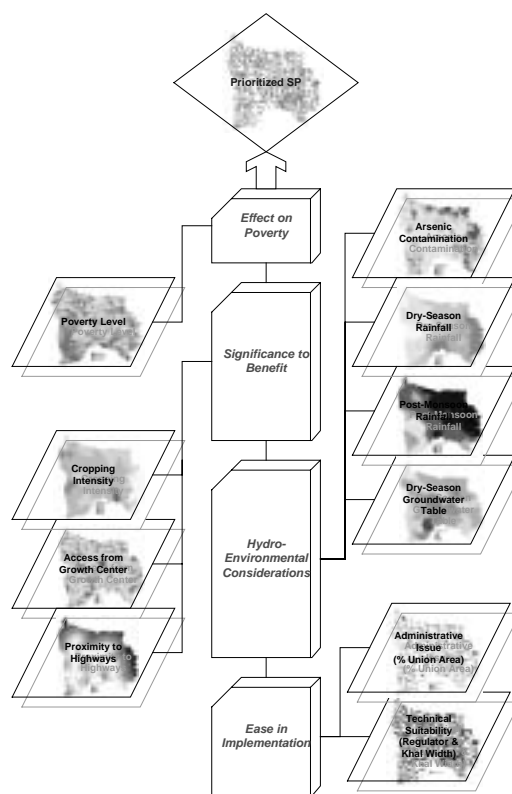
Among implementation, the basic requirements for SSWRD subprojects will be covered by applying the selection criteria of SSWRDSP-2. In this regard, scoring for prioritization of potential subprojects shall concentrate on selecting subprojects that may have more positive effect than the others. The items for considering the scoring of the subprojects are: 1) Effect on Poverty by the Subproject (applicable to all types of subprojects), 2) Significance of Benefit, 3) Hydrological and Environmental Considerations, and 4) Easiness in Implementation of the Subproject and O&M by Local Beneficiaries.

d) Weighting of Scoring Criteria

The basic idea of calculating evaluation weight of categories/items and scoring of individual items are shown in the table below. Importance of each factor is calculated so that the total of each category / item will sum up to a total of one (1). The method and weight of each criterion for prioritization are indicated in the following table.

In applying the AHP method, overlaying subproject with various data collected, updated and developed by the study team and converted them to buffers and grids, has been carried out under GIS environment. The figure on the right gives an image of the GIS data layers used in prioritization.

Sensitivity Analysis has been carried out to check the effect of weight of particular criteria on overall scores of the sub-projects. This eliminates skewness in sub-project priority such that a single criterion doesn't play a sharp role in overall priority and smoothes out the effect of different criteria. Through such sensitivity analysis, the final weights of the criteria have been decided. The table in the next page shows the final criteria and weight.



AHP Data Layers

Weight of Multi-Level Criteria for Subproject Prioritization

Primary Criteria (Level 1)	Weight	Secondary-Criteria (Level 2)	Weight	Tertiary Criteria (Level 3)	Weight	
Effect on Poverty by the Subproject (Applicable to all types of SPs)	0.61*	Very High Poverty Area	0.59	-	-	
		High Poverty Area	0.22	-	-	
		Moderate Poverty Area	0.12	-	-	
		Low Poverty Area	0.07	-	-	
Significance of Benefit (applicable to all types of SPs)	0.13*	Cropping Intensity	0.75	Low having Inundation Land Type F3 & F4	0.76	
				Medium having Inundation Land Type F2	0.16	
				High having Inundation Land Type F0 & F1	0.08	
	Access to and from Growth Center	0.18	Easy	Moderate	Difficult	0.68
						0.22
						0.10
	Proximity to National and Regional Highways	0.07	Close	Moderate	Far	0.68
0.22						
0.10						
Hydrological and Environmental Considerations (depends on types of SP)	0.10*	Arsenic Contamination (applicable to WC type only)	0.64*	High Contaminated Area	0.69	
				Medium Contaminated Area	0.23	
				Low Contaminated Area	0.08	
	Dry Season Rainfall: Nov. ~ Mar. (applicable to WC type only)	0.14*	Low Rainfall	Moderate Rainfall	High Rainfall	0.65
						0.23
						0.12
	Post-Monsoon Rainfall: Sep. ~ Oct. (applicable to DI type only)	0.14*	High Rainfall	Moderate Rainfall	Low Rainfall	0.65
						0.23
						0.12
Dry Season Ground Water Table: Nov. ~ Mar. (applicable to WC/ CAD type only)	0.08*	Deep Groundwater Table	Medium Groundwater Table	Shallow Groundwater Table	0.65	
					0.23	
					0.12	
Easiness in Implementation of the SP and O&M by Local Beneficiaries in the SP Area (applicable to all types of SPs)	0.16*	Administrative Issue	0.75	Single Union	0.83	
				Multiple Unions	0.17	
		Technical Suitability	0.25	Structures are of adequate scale	0.90	
				Structures exceed adequate scale	0.10	

* Different weight applied depending on type of SPs. For detailed figure, refer to Annex-7.

2) Prioritization of Potential Subprojects

a) Screening of D Category Subprojects

Screening of Category D subprojects were done based on the costs of individual subprojects estimated from their components. In the District, out of the 102 qualified subprojects, 36 subprojects were determined to have costs exceeding US\$ 500/ha (or US\$ 1,000/ha for CAD type subprojects) and they were categorized into Category D. The numbers of such subprojects in the District are indicated below.

Screening of Category D Subprojects

District	Number of qualified subprojects	Number of category D subprojects	Number of category A- C subprojects	Gross area of category A-C subprojects (ha)	Average gross area of category A-C subprojects (ha)	Total area in the District (ha)	% of gross area of category A-C subprojects within the District
Tangail	102	36	66	33,437	506.6	341,400	9.8
Study Area Total	496	146	350	200,942	574.1	1,667,200	12.1

Type-wise Number of Category D Subprojects

	FM	DI	CAD	WC	FMDI	FMWC	DIWC	FMDI & WC	District Total
Tangail	6	3	0	7	11	2	2	5	36
Study Area Total by type	32	3	2	22	25	7	32	23	146

b) Prioritization of Qualified Subprojects

After screening of Category D subprojects, each of the remaining subprojects are marked with a score indicating its relative importance in the light of the set criteria. The scores varied from 0.18 to 0.98 with the average of 0.45. However, it should be noted that because of the characteristics of the AHP method, the scores do not indicate the value of actual importance of the subprojects, but represent relative importance between the subprojects.

Prioritization of the scored subprojects was done upazila-wise in regard of the capacity of the Upazila Engineer office in implementation. One subproject with the highest score was selected in each upazila for implementation under the short-term activities of the Master Plan. Such subprojects were categorized as Priority A. Furthermore, some 30% were selected from the remaining 55 subprojects for categorization in Priority B. This counted up to 19 subprojects. Finally, the remaining 36 subprojects were categorized into Priority C, which will be implemented under the long-term activities of the Master Plan. The prioritized subprojects have been checked upazila-wise and then district-wise so that implementations of the prioritized subprojects become distributed among the upazilas and districts. Lists of prioritized subproject in each district are shown in Table 4.2. The following table summarizes the number of subprojects in each category. The distribution of prioritized subprojects is indicated in Fig. 4.3.

Prioritized Verified Potential Subprojects by Type

	FM	DI	CAD	WC	FMDI	FMWC	DIWC	FMDI & WC	Total	BWDB related
Category A	3	1	0	1	0	1	3	2	11	3
Category B	1	9	0	1	2	0	4	2	19	6
Category C	3	15	0	2	5	0	8	3	36	9
Category D	6	3	0	7	11	2	2	5	36	11
Total	13	28	0	11	18	3	17	12	102	29

Chapter 5 Master Plan on Small Scale Water Resources Development

5.1 Basic Concepts of Small Scale Water Resources Development Plan

(1) Objectives

The National Water Policy (NWPo) has been formulated to provide direction to all agencies working with the water sector, and institutions that relate to the water sector, for achievement of specified objectives. Under this policy, the sector agencies of Government and local bodies will prepare sub-regional and local water-management plans and approved Government project appraisal guidelines. In regard of the above, the Master Plan of District Water Resources Development has been started by LGED including the Study covering 6 districts in Greater Mymensingh as one of the pioneers. The overall goal of the Study is to secure safe and sustainable water resources management and to increase farmers' income. The Master Plan is prepared comprising of strategies, prioritized subproject list, priority programs, and the scope for the follow-on investment project which include effective use of surface water.

(2) Basic Concepts of the Small Scale Water Resources Development

Integrated Rural Development: Improvement plan of agriculture, livestock, and fisheries including extension credit, system, post harvesting, marketing, etc., shall be conducted in the subprojects.

Water Resources Development complying with NWPo and NWMP: The Master Plan prepared through this Study should be positioned under the NWPo and NWMP, and must be in line with the contents of the policy.

Flood-proofing in Small Scale Water Resources Development: Human life shall be protected from all the conceivable floods. In reality, complete flood-proof conditions cannot be realized, and flood-proofing would be improved only in steps both in areal extent and increase level of protection.

Participatory Development Process: At all stages of the subproject, local stakeholders shall be involved or participated in order to formulate the ownership of the subproject.

Income Generation for Weak through the Project Implementation: Specific measures shall be taken to ensure the poor, marginal/small farmers and destitute women benefit from the subprojects through LCA.

Institutional Strengthening: Small scale water resources development is implemented in the rural area, and Union and Upazila level officials shall act as the enabler. But considering the present conditions, they need capacity building for implementation.

5.2 Small Scale Water Resources Development Plan

(1) Target Year and Phasing of the Implementation

The target year of these plans, the target year of the Master Plan shall be the year of 2015. And the target year of the Master Plan is set in the following three stages;

- Short Term: by 2007 to complete the feasibility study and construction of high priority subprojects
- Mid Term: by 2010 to implement the high priority subprojects within the SSWRDSP-2 as much as possible
- Long Term: by 2015 to complete all permissive subprojects

(2) Strategy of Small Scale Water Resources Development Plan

Basically the implementation of Master Plan will follow the on the line of SSWRDSP-2 after modification of its procedures.

Upazilas in the Study Area is categorized into five (5) zones; 1) highland, 2) medium highland, 3)

Medium lowland, 4) lowland, and 5) very lowland. Strategies for the small scale water resources development of each zone shall be set as follows:

Highland: The Madhupur Tract area is a typical area of the highland zone. Strategy of SSWRD shall be based on water retentions of the monsoon flood water and rainfall for irrigation during the dry season. The development potential of the pond at the depression of the hill shall be examined.

Medium highland: The medium highland spreads outside of the highland zone in the old Brahmaputra flood plain. Strategy of the SSWRD of the zone shall be based on flood management to reduce damage of *aman* at the beginning of flood season and to drain submerged water for the early re-trans planting *aman* paddy.

Medium lowland: The medium lowland spread outside of the lowland and the young Brahmaputra and Jamuna rivers. The strategy of SSWRD shall be based on flood management to delay the submergence of grown *aman*, and drainage after flooding. Embankment height will be reasonably set.

Lowland: The lowland with inundation depth between 180 and 300 cm spread outside of the Haor area. Because of the inundation depth, flood proofing in this zone is rather difficult without major river flood management, and strategy of SSWRD shall be concentrated mainly on drainage after flood season.

Very lowland: The very lowland zone is the *Haor* area of the old Meghna estuarine flood plain. The strategy of the small scale water resources development shall be mainly concentrated to the drainage acceleration before *boro* cultivation and flood management of early flood.

Char Land: In this Study, char area will be mostly concentrated or prioritized in the stable char area in Jamalpur district as same as adopted by the FPP.

Paurshavas: In this Master Plan Study, paurshavas areas are excluded from the Study Area.

(3) Upazila-wise hydrological condition and Development Strategy of SSWRD

1) Basail Upazila

The Upazila locates in the North Central Hydrological Region. The main rivers are; Bangshi River running along the western border of the Upazila, the Lohajang River entering from northwest to the center of the Upazila and the Langli River devising the Upazila east and west. Notable beels are Chapra and Dubai beels. The annual average rainfall at Atia (Tangail), the nearest station, is recorded 2,014 mm, 68% of it is concentrated in monsoon season and only 3.7% of the annual rainfall in dry season. The land in the Upazila is at the elevation between 3 m to 10 m, PWD.

Most part of the Upazila classified as medium lowland of Old Brahmaputra Floodplain (66%) and medium highland of Young Jamuna Floodplains (34%).

The strategy of SSWRD in the medium highland and medium lowland will be the flood management to reduce the damage of planted paddy in the pre-monsoon season and drainage improvement at post monsoon season to accelerate transplanting Aman or Boro paddy. For the lowland area, embankment height of polder will be reasonably set along the border of the benefited area.

2) Bhuapur Upazila

The Upazila locates in the North Central Hydrological Region. Jamuna is the main river of the upazila. The annual average rainfall at BWDB Kalihati station, the nearest station, is recorded at 1,621 mm of which 70 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 7 m to 15 m, PWD.

Most part of the Upazila classified as medium highland of Young (58%) and Active Jamuna Floodplains. Strategy of SSWRD in medium highland is described in 1) Basail Upazila. There are char lands in the Upazila, only the stable char land, effects of the erosion have not been observed for 20 years or longer, will be targeted in the Master Plan. The strategy of SSWRD in char land will be flood management by structural measures such as flood wall or embankment with slope lining.

3) Delduar Upazila

The Upazila locates in the North Central Hydrological Region. Main rivers are; the Dhaleshwari River

running near to the western border of the Upazila, the Louhagang/Futjani River at east and Elangjani River at the center of the Upazila. The annual average rainfall at BWDB Tangail (Atia) station, the nearest station, is recorded at 2,014 mm, 68% of it concentrated in monsoon season and only 3.7% of the annual rainfall in dry season. The land in the Upazila is at the elevation between 5 m to 15 m-PWD.

All of the Upazila area are classified as medium highland of Young Jamuna Floodplains. Strategy of SSWRD in medium highland is described in 1) Basail Upazila.

4) Ghatail Upazila

The Upazila locates in the North Central Hydrological Region. Main rivers are the Bangshi, Jhenai, Lohajang, Salisundar rivers. Eastern half of the Upazila is in Madhupur Tract, noted hills are Deopara, Dhalapara and Sagardighi. The annual average rainfall at BWDB Kalihati station, the nearest station, is recorded at 1,621 mm of which 70 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 7 m to 15 m-PWD.

Most part of the Upazila classified as highland of Madhupur Tract (51%) and medium highland of Old Brahmaputra Floodplains (32%). The strategy of SSWRD in the highland zone will be the water conservation or retention of the monsoon floodwater and rainfall to use the irrigation during the dry season. Strategy of SSWRD in medium highland is as described in 1) Basail Upazila. SSWRD of forest area in Madhupur Tract shall be planed carefully with natural and forest conservation.

5) Gopalpur Upazila

The Upazila locates in the North East Hydrological Region. Main rivers are the Jhinai, atrai and Bairan; main depressions are Helancha Beel, Barashila Beel and Gaila Beel. The annual average rainfall at BWDB Saishabari station, the nearest station, is recorded at 2,159 mm of which 69 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 10 m to 20 m-PWD.

Most part of the Upazila classified as medium highland of Young Jamuna Floodplains (84%). Strategy of SSWRD in medium highland is as described in 1) Basail Upazila.

6) Kalihati Upazila

Main rivers of the Upazila are; the Jamuna, Lohajang and Old Dhaleshwari rivers in the western part of Upazila, the Bangshi River running on the eastern border, and the Nangal River. There are 17 depressions, most of which noted are Charan, Baisha, Kumar and Talla Beels. The annual average rainfall at BWDB Kalihati station is recorded at 1,621 mm of which 70 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 7 m to 30 m-PWD.

Most part of the Upazila classified as medium highland of Young and Active Jamuna Floodplains (62%) and medium lowland of Old Brahmaputra Floodplain (21%). Strategy of SSWRD in medium highland and medium lowland are described in 1) Basail Upazila. There are char lands in the western apart of Upazila, the strategy of SSWRD in stable char land is as described in 2) Bhuapur Upazila.

7) Madhupur Upazila

The Upazila locates in the North Central Hydrological Region. Main rivers are the Jhinai, Bangshi, Banar and Atrai rivers. Western hafe of the Upazila is covered by the forest area of Madhupur Tract, and Madhupur National Park locates in northeastern part of the Upazila. The annual average rainfall at BWDB Gopalpur station, the nearest station, is recorded at 1,708 mm of which 70 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 10 m to 20 m-PWD.

Most part of the Upazila classified as highland of Madhupur Tract (55%) and medium highland of Old Brahmaputra Floodplains (33%). The strategy of SSWRD for the highland zone is as described in 4) Ghatail Upazila, also for the medium highland is as described in 1) Basail Upazila. Careful attention s shall be paid to the conservation of forest and protection of National Park in the SSWRD.

8) Mirzapur Upazila

The Upazila locates in the North Central Hydrological Region. Main rivers are; the Bangshi River and Elangjani; the upazila has Salban (Shoria forest). Western half of the District is covered by the Madhupur Tract. The annual average rainfall at BWDB Mirzapur station is recorded at 1,757 mm of which 65 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 5 m to 15 m-PWD.

Most part of the Upazila classified as medium highland of Young Jamuna Floodplain (58%) and highland of Madhupur Tract (37%). The strategy of SSWRD for the highland zone is as described in 4) Ghatail Upazila, also for the medium highland is as described in 1) Basail Upazila. Careful attentions shall be paid to the conservation of forest in the Madhupur Tract.

9) Nagarpur Upazila

The Upazila lies on the eastern bank of the Jamuna Rivers. Main rivers are the Jamuna, Dhaleshwari, Old Dhaleshwari, Lohajang, and Noai rivers. The annual average rainfall at BWDB Mirzapur station, the nearest station, is recorded at 1,757 mm of which 65 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 5 m to 15 m-PWD.

The Upazila is classified as medium highland of Active or Young Jamuna floodplains, which covers 83.8% and 16%, respectively. Along with the Jamuna River, area is damaged by the riverbank erosion.

Strategies of SSWRD in the medium highland is as described in 1) Basail Upazila and in the char land in active Jamuna floodplains is as described in 2) Bhuapur Upazila.

10) Sakhipur Upazila

The Upazila locates in the Madhupur Tracts and belongs to the North Central Hydrological Region. Main rivers are; the Bangshi running along the western border of the Upazila and Salda rivers. The annual average rainfall at BWDB Kalihati station, the nearest station, is recorded at 1,621 mm of which 70 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 5 m to 20 m-PWD.

92% of the Upazila is classified as highland of Madhupur Tract. SSWRD strategy in the highland is as described in 4) Ghatail Upazila.

11) Tangail Sadar Upazila

The Upazila lies on the eastern bank of the Jamuna Rivers. Main rivers are the Jamuna, Dhaleshwari and Lohajang rivers. The annual average rainfall at BWDB Atia (Tangail) station is recorded at 2,014 mm of which 68 % of rainfall concentrates in monsoon season. The land in the Upazila is at the elevation between 7 m to 15 m-PWD.

The Upazila is classified as medium highland of Active or Young Jamuna floodplains, which covers 38% and 62%, respectively. Along with the Jamuna River, area is damaged by the riverbank erosion.

Strategies of SSWRD in the medium highland is as described in 1) Basail Upazila, and in the char land in active Jamuna floodplains is as described in 2) Bhuapur Upazila.

5.3 Relevant Sectors' Development Strategies and Plan

(1) SSWRDP and Other Relevant Sector Development Plans

As the nature of SSWRD other sector activities can not involve in the project like those in integrated rural development. It is considered that beneficiary sector activities will be implemented by the other financial resources. However, beneficiary sector development shall be implemented together with small scale water resources development in order to achieve the targets of the Master Plan.

(2) Agricultural Development (ref. Table 5.2)

- Improve human nutrition by diversified agriculture
- Focus on profitable farming through higher productivity

- Upgrade of general agricultural technology–Technical packages other than water management will not be obstacle to agricultural production
- Collaborate with other agricultural projects
- Develop Value Added Agriculture
- Develop community-based activities to fulfill basic regional needs for the rural human security
- Develop wide-area based water management: Ex. Multiple function of paddy fields
- Human Resources Development

(2) Fishery Development (ref. Table 5.3)

- Encouragement of integrated fish culture
- Introduction of tilapia culture
- Introduction of freshwater prawn culture
- Introduction of freshwater ornamental fish culture
- Conservation of indigenous/natural fish in Beel, Khal, River and Haor
- Propagation of indigenous/natural fish by fish culture

(3) Livestock Development

- Stability of feed supply
- Development of animal health
- Processing/ slaughtering of animals

(4) Suggestions to Future Development in Agriculture and Livestock

- Rice Terrace Cultivation in. Haor Area
- Rural Industrial Complex
- Development of vaccination system in rural areas.
- Efficient Irrigation Technology in Highland Area.
- Small Scale Mechanization
- Field Training for Seed Production and Processing for Farmers Own Use.
- Development of Rural Recycling in Farming System
- Integrated forestry-livestock farming
- Development of market information system for fish and fresh vegetables
- Human Resources Development

5.4 Priority Programs

In order to implement the SSWRD Project smoothly and assure the expected effects, the priority programs will be conducted in parallel with the SSWRD subproject implementation.

(1) Collaboration and Coordination among Stakeholders

Collaboration works with relevant government agencies are strongly expected to the implementation of SSWRD Project. National, district and Upazila level government agencies coordination committees should be maintained to achieve multiplication effects of the Project.

(2) Strengthening of Local Government Engineering Department

In order to support smooth implementation of daily works of the Project office equipment and facilities will be improved at District and Upazila level offices. This includes transportation vehicles, computer and peripherals/software, photocopy machines, etc.

(3) Capacity Building of the Local Government Level Technical Officers

There are not enough water resources development planners/engineers in LGED, especially at district and upazila level. Technical training program shall be considered to strengthen the capacity of local government officials of LGED for planning and implementation of SSWRD.

(4) Water Management Associations

In order to maintain the sustainability of SSWRDP sub-projects, capacity building of WMA members

is indispensable. In parallel with training of WMA members, national level federation of WMAs will be formulated to exchange experiences and information among individual WMAs.

(5) GIS and IT

At present, the GIS coordination system between WARPO and LGED is deferent. Standardization is required for exchanging information of GIS. Inventory of water bodies and existing projects under the NWRD is no completed yet. It needs to formulate nation wide inventory survey of water resources among stakeholders under the coordination of WARPO.

5.5 Implementation Plan (Action Plan)

(1) Project Implementation

The Project aims to achieve the sustainable agriculture and improve the farmers’ living conditions through increase of agricultural production and resources mobilization in the Project Area. The Project consists of two major components; 1) SSWRD Subprojects and 2) Priory programs. Considering the similarity of interventions, implementation arrangement of SSWRDSP-2 will be applied for the Project with improvement, if appropriate. The Project is basically assumed to be implemented by the Bangladesh Government budget with external financial support. The LGED will be the executing agency of the Project.

(2) Executing Agencies

The project management office (PMO) will be established at LGED headquarters. The major functions of the PMO are: i) coordination of agencies concerned, ii) preparation of overall implementation plan, annual project work plans and budget, iii) review and approve subproject appraisals, iv) review and approve designs, v) supervise LGED district offices in preparing tender documents, evaluating bids, and awarding contracts, vi) maintain financial accounts, vii) prepare periodic reports on implementation progress and viii) monitor project progress and evaluate environmental impact. PMO will procure the consultants to support the PMO on the technical aspects and institutional strengthening.

Under close guidance and supervision of the PMO, LGED district offices will be responsible for the day-to-day implementation at the subproject level with assistance from the upazila offices. The LGED district Executive Engineer will act as Subproject Manager and 1) prepare individual subproject implementation with stakeholder participation, 2) coordinate with other agencies and organizations, 3) support organization of WMAs, 4) carry out field surveys, 5) supervise construction activities and make payments to contractors, and 6) monitor and report subproject development to the PMO.

At National Level, Inter-ministerial Coordination Committee (IMCC) shall coordinate the agencies for smooth implementation of the Project. District-level Small-scale Water Resources Development Committees (DSSWRDCS) will meet when required to coordinate the activities of the district level Government agencies. MLGRDC will issue an order requiring the Upazalial Development Coordination Committee (UDCC), composed of the union chairpersons and upazila-level officials, to put the review of subproject progress on the agenda of all its regular meetings. LGED district offices will maintain close coordination with BWDB through the Inter-Agency Project Evaluation Committee to ensure that proposed

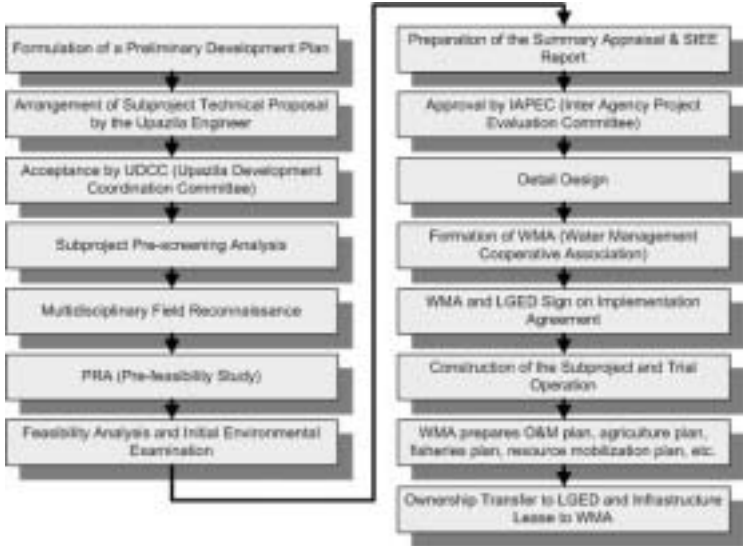


Diagram of Subproject Implementation

subprojects to coordinate with planned or existing BWDB projects.

(3) Implementation Plan

Identification and appraisal process for an individual sub- project on SSWRDSP-2 set by the LGED are as indicated in the diagram of previous page.

The high priority subprojects, after prioritization, are not equally distributed to each district and upazila. Some Upazila concentrate many high priority subprojects and only few high priority subprojects in some upazila. If subproject selected to implement from higher priority, some upazila has no subproject and some upazila concentrate more than 3 subprojects. To avoid these cases, SPs will be selected based on higher prioritized subprojects in the upazila.

Selection of subprojects in each phase are shown in Table 5.1 and as follows:

Short term (2 years): 11 Priority A subprojects which are the highest priority in each upazila
Medium term (3 years): 19 Priority B subprojects which are the secondary highest priority in each upazila
Long term (5/4 years): 36 Priority C subprojects which are the tertiary highest priority in each upazila

Civil works of subproject will be contracted with local contractors under local competitive bidding (LCB) under the standard LGED procurement procedures. Small scale earthwork contracts with labour contracting societies (LCSs).

After completion of the subproject construction, WMA conduct O&M/management under guidance of Upazila engineer office for one year. After one year, O&M committee of WMA takes responsibility of subproject O&M. WMA bare the O&M expenses by collecting fees, based on the investment cost of subproject, from WMA members.

Implementation schedule of the whole Project component are indicated in the following chart.

Phase	Short Term		Medum Term			Long Term					Total
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Small Scale Water Resources Development (Number of Subproject)											
Tangail District	5	6	6	6	7	8	9	10	9		66
Study Area Total	25	33	29	33	37	46	50	52	45	0	350
Monitoring & Evaluation by PMO											
Engineering Services											
Priority Programs											
Capacity Building of Upazila Engineers Office											
Training of WMA Management Board Members											
GIS Database system improvement											
Collaboration works on the Stakholders											

(4) Subproject Investment Costs

Subproject investment cost of 66 subprojects in the District is estimated at Tk. 590.9 million, based on the unit rates of SSWRDSP-2. Their breakdowns by the short, medium and long term periods are summarized as follows:

Terms	Total Number of SP	Total Gross Area (ha)	Average Gross Area (ha/SP)	Investment Costs in Tk. '000'				
				Earthworks	Structures	Total Construction	Land Acquisition	Total Investment
Short Term	11	4,187	381	34,977	44,500	79,477	2,604	82,081
Medium Term	19	9,654	508	68,761	86,522	155,283	3,309	158,592
Long Term	36	18,516	514	193,216	152,900	346,116	4,080	350,196
Total	66	32,357	490	296,955	283,922	580,877	9,993	590,869

Notes: *direct investment costs only, not including engineering service, contingencies, price escalations etc.

Chapter 6 Further Activities Required at Upazila Level

Potential subprojects identified and prioritized through surveys under the Study are only at the initial stage of the whole procedure. Upazila LGED is required to take necessary measures to mature the technical proposals of these subprojects. In this process, emphasis should be put on potential subprojects with higher priority. At the actual proposal preparation stage, some of them will be selected and requested as subprojects for SSWRDSP-2 or BWDB projects.

6.1 Union Level

The potential subproject appeared through the discussion with UP members and representatives of villagers. It is necessary to discuss among the potential stakeholders at union level to confirm the needs and get the consensus among stakeholders to the potential subproject. It is recommended to conduct the PRA among stakeholders as the JICA Study Team demonstrated in Noabad, Joyka nad Boulai Unions of Karimganj Upazila in the District. During the formulation of consensus of the potential subproject, technical assistance will be required from the upazila engineer's staff. The proposal will be discussed and authorized at UP meeting for submission to Upazila Engineer.

6.2 Upazila Level

After the approval of the prioritized potential subproject list, the upazila engineers are expected to start the technical support for the stakeholders' discussions/workshops in the union level for the preparation of the technical proposal to submit to District LGED executive engineers.

Table 1.1 Outline of National Water Policy (NWPo)

Issues	Description
<i>River Basin Management</i>	The government will work with co-riparian countries to establish a system for exchange of information and data on relevant aspects of hydrology, morphology, water pollution, ecology, changing watershed characteristics, cyclone, drought, flood warning, etc., and to help each other understand the current and emerging problems in the management of the shared water sources.
<i>Planning and Management of Water Resources</i>	<ul style="list-style-type: none"> • WARPO will prepare, and periodically update, a NWMP addressing the overall resource management issues in each region and the whole of Bangladesh. • Sector agencies of the government and local bodies will prepare and implement sub-regional and local water-management plans in conformance with the NWMP and approved government project appraisal guidelines. The Executive Committee of the National Water Resources Council (ECNWRC) will resolve any interagency conflict in this regard. • BWDB will implement all major surface water development projects and other FCDI projects with command area above 1,000 hectares. The Local Government will implement FCDI projects having a command area of 1,000 hectares or less after identification and appraisal through an interagency Project Appraisal Committee. Any interagency dispute will be resolved by means prescribed by the government
<i>Water Rights and Allocation</i>	<ul style="list-style-type: none"> • In general, the priority for allocating water during critical periods in the water shortage zones will be in the following order: domestic and municipal uses, non-consumptive uses (e.g. navigation, fisheries and wild-life), sustenance of the river regime, and other consumptive and non-consumptive uses such as irrigation, industry, environment, salinity management, and recreation. The above order of priority could however be changed on specific socio-economic criteria of an area by local bodies through local consensus. • The government may empower the local government or any local body it deems fit, to exercise its right to allocate water in scarcity zones during periods of severe drought, and it will monitor the water regime and enforcement of the regulations through specifically designed mechanisms.
<i>Public and Private Involvement</i>	<ul style="list-style-type: none"> • The management of public water schemes, barring municipal schemes, with command area up to 5,000 ha will be gradually made over to local and community organizations and their O&M will be financed through local resources. • Public water schemes, barring municipal schemes, with command area of over 5,000 ha will be gradually placed under private management, through leasing, concession, or management contract under open competitive bidding procedures, or jointly managed by the project implementing agency along with local government and community organizations. • Ownership of FCD and FCDI projects with command area of 1,000 ha or less will gradually be transferred to the local governments, beginning with the ones that are being satisfactorily managed and operated by the beneficiary/ community organizations.
<i>Public Water Investment</i>	<ul style="list-style-type: none"> • Planning and feasibility studies of all projects will follow the Guidelines for Project Assessment (GPA), the Guidelines for People's Participation (GPP), the Guidelines for Environmental Impact Assessment (EIA), and all other instructions that may be issued from time to time by the government. • Interests of low-income water users, and that of women, are adequately protected in water resource management.
<i>Water Supply and Sanitation</i>	<ul style="list-style-type: none"> • Preserve natural depressions and water bodies in major urban areas for recharge of underground aquifers and rainwater management. • Mandate local governments to create awareness among the people in checking water pollution and wastage.
<i>Water and Agriculture</i>	<ul style="list-style-type: none"> • Improve efficiency of resource utilization through conjunctive use of all forms of surface water and groundwater for irrigation and urban water supply. • Strengthen crop diversification programs for efficient water utilization.
<i>Water and Industry</i>	Standards of effluent disposal into common watercourses will be set by WARPO in consultation with DOE
<i>Water and Fisheries and Wildlife</i>	<ul style="list-style-type: none"> • Water bodies like baors, haors, beels, roadside borrow pits, etc. will, as far as possible, be reserved for fish production and development. Perennial links of these water bodies with the rivers will also be properly maintained. • Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding.
<i>Water and Navigation</i>	<ul style="list-style-type: none"> • Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken. • Minimum stream-flows in designated rivers and streams will be maintained for navigation after diversion of water for drinking and municipal purposes.
<i>Water for Hydropower and Recreation</i>	Recreational activities at or around water bodies will be allowed provided it is not damaging to the environment.
<i>Water for the Environment</i>	<ul style="list-style-type: none"> • Give full consideration to environmental protection, restoration and enhancement measures consistent with the National Environmental Management Action Plan (NEMAP) and the NWMP. • Adhere to a formal environmental impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects, in each water resources development project or rehabilitation program of size and scope specified by the Government from time to time. • Protect against degradation and resuscitate natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes.
<i>Preservation of Haors, Baors, and Beels</i>	<ul style="list-style-type: none"> • Haors that naturally dry up during the winter will be developed for dry season agriculture. • Take up integrated projects in those water bodies for increasing fish production.
<i>Economic and Financial Management</i>	<ul style="list-style-type: none"> • Water charges realized from beneficiaries for O&M in a project would be retained locally for the provision of services within that project. • Effective beneficiary participation and commitment to pay for O&M will be realized at the project identification and planning stages by respective public agencies.
<i>Research and Information Management</i>	Develop a central database and management information system (MIS) consolidating information from various data collection and research agencies on the existing hydrological systems, supply and use of national water resources, water quality, and the eco-system.
<i>Stakeholder Participation</i>	<ul style="list-style-type: none"> • The "Guidelines for People's Participation (GPP) in Water Development Projects" be adhered to as part of project planning by all institutions and agencies involved in public sector management of water resources. • Guidelines for formation of water user groups (WUG) and similar community organizations will be formulated. • Generally 25 % of the earthwork of any public water project will be offered to specific target groups or beneficiaries. • New projects proposed by a community or local institution will be considered for implementation on a priority basis only when the beneficiaries have mobilized a certain percentage of the total cost as their contribution to the project.

Table 4.1 List of Subprojects Proposed to SSWRDSP-2 in Tangail District

Upazila / Total SP	Union	No. of SP	Proposed Subproject Name	Pre-screening	Reconnais sance	PRA	Appraisal	
Bhuapur	4	Aloa	1	Nikla Beel-Gabira Beel Subproject	X			
		Fulda	2	Guza Beel Subproject	Passed	Passed	Passed	Passed
				Terilla Beel Subproject	Passed	Passed	Passed	In process
		Pourashaba	1	Pingra Beel Subproject	X			
Ghatail	5	Dewpara	1	Shanki Bhanga Khal Subproject	Passed	Passed	Passed	Passed
		Dhalapara	1	Chapra Beel-Nedher Beel-Beel Jalanga Subproject	Passed	X		
		Rasulpur	2	Doli Beel-Atarochura Subproject	Passed	X		
				Gonar Dewli Kata Khali Subproject	Passed	X		
Shandhanpur	1	Shandhanpur Chaiter Khal Subproject	X					
Gopalpur	1	Mirzapur	1	Baeashila Beel Subproject	?			
Kalihati	2	Nagbari	2	Rampur-Shalgrampur Subproject	X			
				Ratanganj Subproject	Passed	Passed	Passed	Passed
Mirzapur	3	Azgana	1	Umed Ali Khal Subproject	Passed	Passed	Passed	Passed
		Fatehpur	2	Fatehpur Bazar-Thalpara Subproject	Passed	X		
				Thalpara Natun Bazar-Chakleshwarl Subproject	Passed	X		
Modhupur	1	Musuddi	1	Koshaibari Khal Subproject	Passed	Passed	Passed	In process
Nagarpur	8	Goahata	3	Porabari Charabari Subproject	X			
				Goahata Bara Khal Pukur Subproject	X			
				Goahata Koitala Subproject	X			
		Mokna	1	Nataung Gohuli Khal Subproject	Passed	X		
		Pakutia	1	Rasta Gola Kum Subproject	X			
		Vadra	3	Mora Neai Khal-Gangbihali Subproject	X			
				Sairal Beel Khal Subproject	X			
Sahjani-Agdimulia Khal Subproject	X							
Shakipur	4	Boheratoil	1	Tanki & Bangshai River Subproject	?			
		Hatibandha	1	Bajail-Goaila River Subproject	Passed	Passed	Passed	In process
		Kakrajan	1	Shail Shindur Khal Subproject	Passed	Passed	Passed	In process
		Kalia	1	Khaliar Baid Newrer Khal Subproject	Passed	Passed	Passed	In process
T. Sadar	1	Katuli	1	Katuli-Ditpur Subproject	Passed	X		
8	28	20	29		12	9	9	4

Note: As of Feb. 2005

Table 4.2 List of Prioritized Potential Subprojects in Tangail District (1/5)

Upazila	Union	ID. No.	Name of Subproject	Type	Gross Area (ha)	BWDB	Priority	Remarks
Basail	Kanchanpur	39309080	Borokati Beel SP	FMWC	278	None	A	
	Fulki	39309010	Maddhyapara-Nirail SP	FM	406	Embankment	B	
	Kashil	39309040	Kashil-Nagashim Embankment SP	FM	154	3 Km BWDB Embankment	C	
	Basail	39309050	Naikangbari-Dongpara SP	FMDI	471	None	D	Further examination to be required
	Kanchanpur	39309070	Pouli and Shingerdak Embankment SP	FM	174	Embankment	D	Further examination to be required
	Kaoaljani	39309230	Nokil, Hatail, Bharta Beel and Kaoaljani Puraton Hat to Gilabari Embankment SP	FMWC	871	None	D	Further examination to be required
	Habla	39309061	Boirpara Sundaribaid Khal SP	FMDIW C	1,385	Embankment	L	Benefited area more than 1,000 ha
Bhuapur	Gobindasi	39319050	Khamerbari-Chithalipara SP	FM	194	Flood Control Embankment and Sluice	A	
	Aloya (Birhati)	39319070	Nikle Beel-Gabaira Beel SP	DI	894	None	B	
	Phulda	39319020	Terilla Beel SP	FMDI	687	None	C	
	Gabsara	39319010	Char Gabsara SP	FMDIW C	561	None	D	Further examination to be required
	Arjuna	39319030	Gobindabari-Balarampur Bhuapur Pourashava SP	FMDI	408	8km long BWDB Embankment	D	Further examination to be required
	Nikrail	39319060	Nikrail SP	FM	319	None	D	Further examination to be required
Delduar	Delduar	39323040	Charpara Beel - Lohajang River SP	DI	444	Embankment by BWDB	A	
	Deoli	39323030	Barair Beel - Dewan Bari Beel - Dhaleswari River SP	DI	288	Embankment by BWDB (Kamar Naogaon Project)	B	
	Delduar	39323100	Bhatkee Beel SP	DI	561	None	B	
	Elasin	39323050	Agelasin - Singaragi Beel - Daleswari River SP	DI	856	Embankment by BWDB	C	
	Fazilhati	39323060	Maishta SP	FM	259	None	C	
	Fazilhati	39323080	Fazilhati Khal SP	DI	517	None	C	
	Pathrail	39323010	Mongothore Beel - Parijatpur Khal SP	WC	166	None	D	Further examination to be required
	Atia	39323020	Atia Mara Nadi (Chala Atia Mosque - Gomjani Village) SP	WC	97	None	D	Further examination to be required
	Dubail	39323070	Baramushta - Badshar Kumb SP	FMDI	108	None	D	Further examination to be required
	Lauhati	39323090	Tarutia Bazar - Char Lanhati - Lanhati Union Parishad Embankment SP	FM	371	Embankment by BWDB (constructed partly by BWDB and partly by LGED.)	D	Further examination to be required

Table 4.2 List of Prioritized Potential Subprojects in Tangail District (2/5)

Upazila	Union	ID. No.	Name of Subproject	Type	Gross Area (ha)	BWDB	Priority	Remarks
Ghatail	Deopara	39328110	Padmakuri Beel-Ranadaha Beel-Kalyan Beel SP	DIWC	562	None	A	
	Deulabari	39328010	Boroitala Khal SP	DIWC	574	None	B	
	Ghatail	39328040	Boithakata Khal SP	DI	62	None	C	
	Anehola	39328070	Dakatia Khal SP	DIWC	903	None	C	
	Digalkandi	39328080	Biara Khal SP	DIWC	950	None	C	
	Loker Para	39328060	Jolapara Khal SP	FMDI WC	354	None	D	Further examination to be required
	Sandhanpur	39328020	Sandhanpur Chiatar Khal SP	DI	1,572	FC embankment along the right bank of Bansi River	L	Benefited area more than 1,000 ha
	Rasulpur	39328031	Doli Beel-Atharochura, Khajnagara-Shinghachala Khal SP	FMDI WC	1,873	None	L	Benefited area more than 1,000 ha
	Jamuria	39328050	Jamuria Flood Management SP	FM	33	None	L	Benefited area less than 50 ha
	Digar, Jamuria & Ghatail	39328091	Futa Nodi-Kuichamara Khal Futamora River/Khal and Bailakhora Khal SP	DIWC	1,482	None	L	Benefited area more than 1,000 ha
Dhala Para	39328100	Chapra Beel-Nedher Beel-Beel Jalanga SP	FMDI	1,374	None	L	Benefited area more than 1,000 ha	
Gopalpur	Nagdasimla	39338040	Doga Beel SP	FMDI WC	388	None	A	
	Hemnagar	39338050	Kholishakuri Beel SP	DI	285	Naypara-Sakharia SP	B	
	Mirzapur	39338080	Borashila Beel SP	FMDI	256	None	B	
	Jahoil	39338010	Digder beel-Dhali beel Khal SP	FMDI	269	Naypara-Sakharia SP	C	
	Jhaoil	39338030	Jhaoil SP	DI	1,038	Harindhara FC Embankment	C	
	Alamnagar	39338060	Hara-Halencha Beel SP	FMDI WC	519	None	C	
	Jhaoil	39338020	Jhenai River Erosion Control SP	FMDI	308	Naypara-Sakharia SP	D	Further examination to be required
	Hadira	39338090	Hadira SP	FMDI WC	196	None	D	Further examination to be required
	Dhopakandi	39338070	Dhopankandi SP	DI	1,219	None	L	Benefited area more than 1,000 ha
Kalinati	Kok Dohora	39347101	Charan Beel SP	FMDI WC	724	None	A	
	Narandia	39347030	Narandia Khal SP	DIWC	477	None	B	
	Sahadebpur	39347080	Shahadebpur SP	DI	745	Embankment	B	
	Bir Basunda	39347130	Birbasunda Beel SP	FMDI WC	860	None	B	
	Durgapur	39347010	Louhajong River SP	DI	198	None	C	
	Elengga	39347040	Bhurbhura Beel SP	DIWC	380	Embankment along the bank of Louhajong River	C	
	Bangra	39347060	Bartha Beel SP	DIWC	493	None	C	
	Bangra	39347070	Bhangra Beel SP	DIWC	348	None	C	

Table 4.2 List of Prioritized Potential Subprojects in Tangail District (3/5)

Upazila	Union	ID. No.	Name of Subproject	Type	Gross Area (ha)	BWDB	Priority	Remarks
Kallihati	Kok Dohora	39347102	Posna-Bheradoha Beel SP	FMDI WC	618	None	C	
	Bir Basunda	39347120	Kumreshe Beel SP	FMDI	376	None	C	
	Paikara	39347150	Khorsilla-Chhotihati Beel SP	DI	710	None	C	
	Salla	39347020	Daosokiya-Dogangi Beel SP	FMDI	668	None	D	Further examination to be required
	Elengga	39347050	Dhulihata SP	FMDI	271	Embankment along the bank of Louhajong River	D	Further examination to be required
	Paikara	39347090	Jolui Beel SP	FMDI	186	Embankment	D	Further examination to be required
	Balla	39347110	Balla SP	FMDI	252	None	D	Further examination to be required
	Nagbari	39347140	Berhbari SP	DI	448	None	D	Further examination to be required
	Balla	39347160	Satbeela Beel SP	FMDI	407	Sluice gate by BWDB	D	Further examination to be required
Madhupur	Birtara	39357010	Goalia Beel SP	DIWC	162	None	A	
	Musuddi	39357030	Musuddi SP	FMDI	680	None	B	
	Dhopakhali	39357050	Charbhanga Khal SP	FMDI WC	486	None	B	
	Paiska	39357040	Kuichamara Khal SP	DI	584	None	C	
	Alokdia	39357090	Benai Beel SP	FMDI	756	None	C	
	Alokdia	39357100	Dubail Beel SP	FMDI	653	None	C	
	Golabari	39357110	Katakhali Khal SP	DIWC	912	None	C	
	Golabari	39357130	Debipur Khal SP	DIWC	288	None	C	
	Mirzabari	39357060	Roya-Hasil Beel SP	DI	231	Jani Khal Regulator	D	Further examination to be required
	Dhopakhali	39357140	Jomsherpur Kandipara SP	DI	87	None	D	Further examination to be required
	Sholakuri	39357070	Sholakuri Rubber Dam SP	DIWC	689	None	DG	Further examination to be required, SP locates in the National Park
	Birtara & Dhanbari	39357022	Dhublai Beel Zia Khal SP	DIWC	1,634	None	L	Benefited area more than 1,000 ha
	Arankhola	39357080	Arankhola Rubber Dam SP	DIWC	2,062	None	L	Benefited area more than 1,000 ha, SP in National Park
	Ausnara	39357120	Ausnara Rubber Dam SP	DIWC	1,733	None	L	Benefited area more than 1,000 ha

Table 4.2 List of Prioritized Potential Subprojects in Tangail District (4/5)

Upazila	Union	ID. No.	Name of Subproject	Type	Gross Area (ha)	BWDB	Priority	Remarks
Mirzapur	Gorai	39366100	Kodialia - Rahimpur Embankment SP	FM	403	None	A	
	Anaitara	39366060	Barinda Bazar - Bodebharra Khal SP	DI	209	None	B	
	Uarsi	39366070	Andipara - Ruail Khal SP	DI	548	None	B	
	Jamurki	39366010	Lohajang Khal SP	DI	686	None	C	
	Banail	39366020	Nordana Khal SP	DI	659	Regulator be BDB	C	
	Anaitara	39366140	Barinda Bazar - Atiamahamudpur - Kumulli Beel - Bodebharra - Nadona Khal SP	DI	302	None	C	
	Fatehpur & Mahera	39366030	Fatehpur - Chakleswar Embankment SP	FMDI	583	None	D	Further examination to be required
	Bhatgram	39366050	Bagjan Beel - Bagjan Khal SP	DIWC	451	None	D	Further examination to be required
	Bahuria	39366110	Dostoripara - Haria Embankment SP	FM	668	None	D	Further examination to be required
	Gorai	39366120	Bonkurtala - Chandulia Embankment SP	FM	478	None	D	Further examination to be required
	Ajgana	39366130	Umed Ali Khal SP	DIWC	340	None	D	Further examination to be required
	Tarappur	39366080	Keshab Khali Khal SP	DI	1,234	Kownai - Kara Khali Embankment	L	Benefited area more than 1,000 ha
	Bastail	39366090	Bansinagar Khal SP	DIWC	1,265	None	L	Benefited area more than 1,000 ha
Nagarpur	Salimabad	39376030	Charghurnipara Khal SP	DIWC	166	One regulator at Ghunipara.	A	
	Mokhna	39376090	Nataung - Gohuli Khal SP	DIWC	859	Embankment by BWDB	B	
	Pakutia	39376100	Basta Khola Khal SP	DIWC	515	None	B	
	Salimabad	39376020	Modhudewan Khal SP	WC	209	None	C	
	Dhuburia	39376040	Dhubaria-Balarampur Khal SP	WC	512	None	C	
	Sahabatpur	39376070	Nalsanda-Khamardholla Flood Management SP	FM	521	Bharra-Betwajani Embankment	C	
	Sahabatpur	39376110	Tokadair-Sahabatpur Khal SP	DI	399	None	C	
	Duptair	39376050	Jaupara-Gotabag and Jamuna's Branch River-Nischintpur Embankment SP	FMDI	613	Nagarpur Upazila Embankment	D	Further examination to be required
	Mamudnagar	39376080	Sanchi-Louhajong Khal SP	FMDI WC	860	None	D	Further examination to be required
	Bharra	39376010	Atpara-Choubaria Khal SP	DI	1,345	Embankment	L	Benefited area more than 1,000 ha
	Bekra Atgram, Bhadra, Gayhata and Nagarpur	39376063	Goihata-Barapusa Khal, Mora Noai Khal - Gangbihali Sairal Khal, Noai Nadi, Ramchandrapur-Alokdia Khal SP	FMDI WC	3,003	Embankment	L	Benefited area more than 1,000 ha

Table 4.2 List of Prioritized Potential Subprojects in Tangail District (5/5)

Upazila	Union	ID. No.	Name of Subproject	Type	Gross Area (ha)	BWDB	Priority	Remarks
Sakhipur	Jadabpur	39385050	Berbari - Shanasipara Embankment SP	FM	157	None	A	
	Jadabpur	39385070	Bari Khal Embankment SP	WC	220	None	B	
	Hatibandha	39385060	Goalia River SP	FMDI WC	925	None	C	
	Gazaria	39385080	Goalia Jhara Khal SP	DI	1080	None	C	
	Baheratal	39385030	Tonki River SP	FMDI WC	1,134	None	D	Further examination to be required
	Kakrajan	39385010	Madla - Shailsindu River and Galakata Khal SP	DIWC	3,974	None	L	Benefited area more than 1,000 ha
	Gazaria	39385040	Gazaria - Goalia Jhara SP	DIWC	1267	None	L	Benefited area more than 1,000 ha
	Kalia	39385020	Please refer to SP 36113020 of Bhaluka/Mymensingh					
Tangail Sadar	Hugra	39395062	Begundal Khal SP	WC	709	None	A	
	Magra	39395040	Bashalia Khal SP	DI	159	?	B	
	Gharinda	39395100	Gharinda Khal SP	DI	632	None	B	
	Baghil	39395030	Basiria Khal SP	DIWC	245	None	C	
	Dyenna	39395070	Binnafoir Khal SP	DI	503	CPP embankment	C	
	Dyenna	39395080	Shingerghona - Ghotokbari - Boro Beel - Dhara Kutia SP	DI	292	CPP embankment	C	
	Karatia	39395110	Lahajong Khal SP	DI	733	None	C	
	Kakua	39395010	Maisa - Chorpolti Embankment SP	FM	575	Omarpur Khal	D	Further examination to be required, Wide land acquisition required
	Magra	39395020	Bahirshimul Khal SP	WC	734	None	D	Further examination to be required
	Gala	39395050	Ghala (Lahajang) Khal SP	WC	357	None	D	Further examination to be required
	Hugra	39395061	Dhulbari - Kashinagar Khal SP	WC	393	None	D	Further examination to be required
	Hugra	39395063	Goiragacha - Alokdia Khal SP	WC	314	None	D	Further examination to be required
	Porabari	39395090	Char Rakkit Belta Beel, Kendua Beel, Indra Beel Khal SP	WC	169	Korotia - Silimpur Embankment	D	Further examination to be required
	Silimpur	39395130	Pakulla Khal SP	FMWC	175	None	D	Further examination to be required
Katuli	39395120	Katuli - Ditpur - Nandiboyra SP	FMDI	1,203	None	L	Benefited area more than 1,000 ha	

Table 5.1 List of Potential Subprojects for SSWRDP in Tangail District (1/6)

SR. No.	Upazila	Proposed union	Priority	SP_ID	Title	Type	Gross Area (ha)	Expected Work Volume		BWDB Project	Investment Cost (Tk. '000)
								Earthworks	Structure		
1	Basail	Kanchanpur	A	39309080	Borokati Beel SP	FMWC	278	Hightening of existing submersible road L=6km, W=3m, H=1.5m Jaotaki -Moteswar	1 No. of 1 vent sluice at Moteswar	None	5,178
2	Bhuapur	Gobindasi	A	39319050	Khamerbari-Chithalipara SP	FM	194	Rehabilitation of embankment cum road (L=3.5km, W= 3m, H=1.35m). Star: Khanurbari-Bhalkuria upto Matikata.	One regulator at Khanurbari.	Flood Control Embankment and Sluice	4,067
3	Delduar	Delduar	A	39323040	Charpara Beel - Lohajang River SP	DI	444	Re-excavation of Khal: L=4km, W=15m, D=3m	None	Embankment by BWDB	7,390
4	Ghatail	Deopara	A	39328110	Padmakuri Beel-Ranadaha Beel-Kalyan Beel SP	DIWC	562	(1) : Re-excavation of Khal (L=5 km, W=10m, D=1.5m) Start: Kallyan-Ranadah-Bongsai river. (2): Re-excavation of Bhua Pancha beel-Deopara-Taltala-Bangsai river	2 regulators.: One at Molajani for (1) and another at Golabari for (2).	None	12,101
5	Gopalpur	Nagdasimla	A	39338040	Doga Beel SP	FMDI WC	388	Re-excavation of Cheragali Khal (L=2km, W=6m, D=1.5m), Rehabilitation of Embankment (L=1.5km, W=5m, H=2m)	1 No. of 2 vent regulator	None	9,196
6	Kalihati	Kok Dohora	A	39347101	Charan Beel SP	FMDI WC	724	Re-excavation of Charan Khal (L=6km, W=5m, D=2m), New excavation of Boalia Khal-Louhojong river (L=3km, W=5m, D=2m), Rehabilitation of embankment (L=2.5km, W=3m, D=2m), New construction of embankment (L=3km, W=3m, D=2.5m)	2 Nos. of 2-vent regulators	None	18,180
7	Madhupur	Birtara	A	39357010	Goalia Beel SP	DIWC	162	Re-excavation of Goalia Beel khal (L=2.5km, W=5m, D=1.5m) Start: Goalia beel and End: Shapla khal. Re-excavation of Shapla Khal (L=1.5km, W=5m, D=2m).	1 No. of 2 vent regulator	None	5,033
8	Mirzapur	Gorai	A	39366100	Kodialia - Rahimpur Embankment SP	FM	403	New construction of Embankment: L=3km, W=3.7m, H=3m Re-excavation of Kodialia Khal L=1km, W=3m, D=1.5m	One regulator	None	6,623
9	Nagarpur	Salimabad	A	39376030	Charghurnipara Khal SP	DIWC	166	Re-excavation of Charghurnipara Khal (L=2.5km, W=6m, D=4 m)	None	One regulator at Ghunipara.	3,790
10	Sakhipur	Jadabpur	A	39385050	Berbari - Shanasipara Embankment SP	FM	157	Improvement of existing road into road cum embankment: L=3km, W=3.7m, H=1.2m	One regulator	None	4,377
11	Tangail Sadar	Hugra	A	39395062	Begundal Khal SP	WC	709	Re-excavation of Begundal Khal: L=1.5km, W=10m, D=2.1m	One regulator at Fatehpur.	None	6,146

Table 5.1 List of Potential Subprojects for SSWRDP in Tangail District (2/6)

SR. No.	Upazila	Proposed union	Priority	SP_ID	Title	Type	Gross Area (ha)	Expected Work Volume		BWDB Project	Investment Cost (Tk. '000)
								Earthworks	Structure		
12	Basail	Fulki	B	39309010	Maddhyapara-Nirail SP	FM	406	Hightening of embankment (L=4km, W=3 m, H=3m) connecting to the existing BWDB embankment. Fulki Madhapara-Karotia-Bathuli pucca road	3 Pipe sluices : i. Fulki Madhapara-1, ii. Nirail (South & North)-2 Regulator-1: At Karotiapara Khal.	Embankment	12,957
13	Bhuapur	Aloya (Birhati)	B	39319070	Nikle Beel-Gabaira Beel SP	DI	894	New excavation of Khal (L=5km, W=4m, D=2m) Start: Nikla beel-Amula Daha Bhorotto-Dhaleswari river.	Two regulators: one at Nikla gopal and another at Nikla.	None	11,783
14	Delduar	Deoli	B	39323030	Barair Beel - Dewan Bari Beel - Dhaleswari River SP	DI	288	Re-excavation of khal: L=3 km, W=9 m, D= 1.5 m	None	Embankment by BWDB (Kamar Naogaon Project)	1,599
15	Delduar	Delduar	B	39323100	Bhatkee Beel SP	DI	561	Re-excavation of Bhatkee-Alsha-Lauhojong river L=3 km, W=9 m, D=1.5 m	None	None	1,599
16	Ghatail	Deulabari	B	39328010	Boroitala Khal SP	DIWC	574	Re-excavation of Boroitala Khal (L=6km, W=9m, D=1.5m) Start: Tok river -Inai river	One regulator at Shaliajan bazar bridge	None	7,797
17	Gopalpur	Hemnagar	B	39338050	Kholishakuri Beel SP	DI	285	Re-excavation of Khal (L=1.5km, W=5m, D=1.75m) and New Excavation of Khal (L=0.5km, W=5m, D=2m)	1 No. of 2 vent regulator	Naypara-Sak haria SP	4,585
18	Gopalpur	Mirzapur	B	39338080	Borashila Beel SP	FMDI	256	Re-excavation of Borashila Khal (L=2 km, W=5m, D=1.5m)	2 regulators of 1m x 1.5m each	None	6,187
19	Kalihati	Narandia	B	39347030	Narandia Khal SP	DIWC	477	Re-excavation of Narandia Khal (L=6km, W=6m, D=1.5m), New excavation of Ghoria Khal (L=1km, W=5m, D=1.5m)-Louhojong river.	2 regulators	None	10,088
20	Kalihati	Sahadebpu r	B	39347080	Shahadebpu r SP	DI	745	Re-excavation of Langulia Khal (L=5.5km, W=5m, D=1.5m), Re-excavation of Subidar Khal (L=2km, W=5m, D=1.5m)	2 regulators	Embankment	10,119
21	Kalihati	Bir Basunda	B	39347130	Birbasunda Beel SP	FMDI WC	860	Re-excavation of Khal (L=5km, W=6m, D=1.75m), New excavation of Khal (L=4km, W=5m, D=1.5m), Rehabilitation of embankment (L=6km, W=3m, D=2.5m), New construction of embankment (L=1km, W=3m, D=2m)	2 Nos. of 2-vent and 1 No. of 3-vent regulator	None	22,823
22	Madhupur	Musuddi	B	39357030	Musuddi SP	FMDI	680	Re-excavation of Khal (L=1km, W=3m, D=2m) New excavation of Khal (1.5km, W=3m, D=2m) New construction of embankment (L=1 km, W=8m, H=1.5m) Start: Roya beel to Bongsai river.	1 No. of 1 vent regulator (1.5m x 2m)	None	5,179
23	Madhupur	Dhopakhali	B	39357050	Charbhanga Khal SP	FMDI WC	486	Re-excavation of Charbhanga Khal (L=7km, W=6m, D=1.75m) New Excavation of Charbhanga Khal (L=2km, W=6m, D=1.5m) Start: Boiran river, and End: Paitka-Bongsai river.	One regulator at Charabhanga	None	8,198

Table 5.1 List of Potential Subprojects for SSWRDP in Tangail District (3/6)

SR. No.	Upazila	Proposed union	Priority	SP_ID	Title	Type	Gross Area (ha)	Expected Work Volume		BWDB Project	Investment Cost (Tk. '000)
								Earthworks	Structure		
24	Mirzapur	Anaitara	B	39366060	Barinda Bazar - Badebharra Khal SP	DI	209	Re-excavation of Barinda Bazar - Badebharra Khal: L=3.5km, W=20m, D=1.8m. Start: Atiamahmudpur-Barindabazar-Nagarpur Upazila.	None	None	4,516
25	Mirzapur	Uarsi	B	39366070	Andipara - Ruail Khal SP	DI	548	Re-excavation of Andipara - Ruail Khal-Louhojong river: L=5km, W=10m, D=1.8m	None	None	3,610
26	Nagarpur	Mokhna	B	39376090	Nataung - Gohuli Khal SP	DIWC	859	Re-excavation of Khal: L=6.75km, W=10m, D=2m. Re-habilitation of BWDB embankment: L=1.5km, W=10m, H=3m	Two regulators. One regulator at Jogtala and another at Buhuri.	Embankment by BWDB	19,580
27	Nagarpur	Pakutia	B	39376100	Basta Khola Khal SP	DIWC	515	Re-excavation of Basta Khola Khal: L=5km, W=10m, D=3.5m	One regulator at Pulsuria of Dighalia UP	None	15,628
28	Sakhipur	Jadabpur	B	39385070	Bari Khal Embankment SP	WC	220	Heightening Salda river embankment: L=0.7km, W=3.6m, H=2.5m	One regulator	None	4,826
29	Tangail Sadar	Magra	B	39395040	Bashalia Khal SP	DI	159	Re-excavation of Bashulia Khal: L=5km, W=15m, D=1.5m	None	?	4,086
30	Tangail Sadar	Gharinda	B	39395100	Gharinda Khal SP	DI	632	Re-excavation of Gharinda Khal: L=4km, W=8m, D=1.8m	Two drainage pipes, one at Darun beel, and another at Ghorinda beel L=1km, Di=0.9m	None	3,433
31	Basail	Kashil	C	39309040	Kashil-Nagashim Embankment SP	FM	154	Rehabilitation of embankment cum road (L=3km, W=4.5 m, H=1.2m. Nayachim bridge-Kashil (Raja master's house)-Pichuri Kachu Khal.	A sluice gate internal drainage	3 Km BWDB Embankment	3,867
32	Bhuapur	Phulda	C	39319020	Terilla Beel SP	FMDI	687	Excavation of Khals (L=5.5km, W=3m, D=1.5m)	4 regulators of 1 vent (1m x 1.5m).	None	12,368
33	Delduar	Elasin	C	39323050	Agelasin - Singaragi Beel - Daleswari River SP	DI	856	Re-excavation of khal connecting Agelasin and Daleswari River via Singaragi Beel: L=6km, W=15m, D=3m	None	Embankment by BWDB	11,085
34	Delduar	Fazilhati	C	39323060	Maishta SP	FM	259	None	One regulator only at Moishta for controlling flood water.	None	3,600
35	Delduar	Fazilhati	C	39323080	Fazilhati Khal SP	DI	517	Re-excavation of Putajani beel-Lauhojong (to Elasin UP and Lauhati UP and ultimate to Mirzapur Upazila). L=2 km, W= 10m, D=2 m Re-excavation of Fazilhati Khal: L=4km, W=15m, D=1.5m	None	None	4,911
36	Ghatail	Ghatail	C	39328040	Boithakata Khal SP	DI	62	Re-excavation of Baihakata Khal (L=1km, W=3.6m, D=2.4m) Start: Tok river-Pungli beel-Boitakhata khal-Konabari-Sankarpur-Jhenai river.	None	None	546

Table 5.1 List of Potential Subprojects for SSWRDP in Tangail District (4/6)

SR. No.	Upazila	Proposed union	Priority	SP_ID	Title	Type	Gross Area (ha)	Expected Work Volume		BWDB Project	Investment Cost (Tk. '000)
								Earthworks	Structure		
37	Ghatail	Anehola	C	39328070	Dakatia Khal SP	DIWC	903	(1):Re-excavation of Dakatia Khal (L=5km, W=9m, D=1.8m) Start: Moladah beel-Anehola beel-Dakatia beel-Salla beel-and End:Jhenai river. (2): Sankhali beel-Jhenai river Re-excavation S/P (L=1 km, W=9m. D=1.5m)	2 regulators. One at Dakatia beel and another at Hatkora Mouza	None	13,058
38	Ghatail	Digalkandi	C	39328080	Biara Khal SP	DIWC	950	Re-excavation of Biara Khal (L=9.5km, W=15m, D=1.35m). Start: Biara-Noicha beel-Badey beel-Jhenai river.	1 sluice gate at Shalanka.	None	11,495
39	Gopalpur	Jahoil	C	39338010	Digder beel-Dhali beel Khal SP	FMDI	269	Re-excavation of Khal (L=2km, W=5m, D=1.5m): Digder beel-Dhali beel Khal	One regulator	Naypara-Sa kharia SP	4,287
40	Gopalpur	Jhaoil	C	39338030	Jhaoil SP	DI	1,038	Re-excavation of Khal (L=6km, W=6m, D=1.5) Start : Golabari khal-Jhenai river-Golla beel-Noilla beel-Digder beel-End: Kanmola khal.	1 No. of 1 vent, 2 Nos. of 2 vent and 1 No. of 3 vents regulators: One at Pakutia khal, one at Jhawaii khal, one at Golabari khal and one at Sowani para khal.	Harindhara FC Embankment	16,895
41	Gopalpur	Alamnagar	C	39338060	Hara-Halencha Beel SP	FMDI WC	519	Excavation of Khal (L=2km, W=7m, D=2m): Start at Jhenai river-via-Hara beel-End: at Helancha beel. New embankment (L=2km, W=3m, H=2.5m)	2 Nos. of 2 vent regulators: One regulator at Madarjani khal and another regulator at Sundar Gopalpur Bhedakhali Mohona.	None	11,302
42	Kalihati	Durgapur	C	39347010	Louhajong River SP	DI	198	Excavation of Beripotol khal-Lowhojong dead river through Beripotol beel. L=2 km, W=21 m, D=2 m	1 regulator at Shamshoil.	None	5,782
43	Kalihati	Elengga	C	39347040	Bhurbhura Beel SP	DIWC	380	Re-excavation of Khal (L=12km, W=5m, D=1.5m), New excavation of Khal (L=2km, W=5m, D=2m)	1 No. of 3-vent regulator	Embankment along the bank of Louhajong River	10,132
44	Kalihati	Bangra	C	39347060	Bartta Beel SP	DIWC	493	Re-excavation of Khal (L=2km, W=5m, D=1.75 m), Rehabilitation of embankment (L=6km, W=8 m, D=3m)	1 No. of 3-vent regulator	None	15,561
45	Kalihati	Bangra	C	39347070	Bhangra Beel SP	DIWC	348	Re-excavation of khal (L=3.5km, W=6m, D=2.5m), Rehabilitation of embankment (L=2.5m, W=8 m, D=3m)	1 No. of 2-vent regulator	None	11,016
46	Kalihati	Kok Dohora	C	39347102	Posna-Bheradoha Beel SP	FMDI WC	618	Re-excavation of Bheradah beel Khal (L=3km, W=5m, D=1.5m), New excavation of Gonokbari Khal (L=3km, W=5m, D=2m), Rehabilitation of embankment (L=2km, W=3m, D=2.5m), New construction of embankment (L=2km, W=3m, D=2m)	2 Nos. of 2-vent regulators	None	14,284
47	Kalihati	Bir Basunda	C	39347120	Kumreshe Beel SP	FMDI	376	Re-excavation of Uzimara Khal (L=4.5km, W=5m, D=1.75m), New excavation of Khal (L=0.4km, W=5m, D=1.5m), Rehabilitation of embankment (L=4.5km, W=3m, D=2m)	2 Nos. of 2-vent regulators	None	12,201

Table 5.1 List of Potential Subprojects for SSWRDP in Tangail District (5/6)

SR. No.	Upazila	Proposed union	Priority	SP_ID	Title	Type	Gross Area (ha)	Expected Work Volume		BWDB Project	Investment Cost (Tk. '000)
								Earthworks	Structure		
48	Kalihati	Paikara	C	39347150	Khorsilla-Chhotihati Beel SP	DI	710	Re-excavation of Khal (L=5.5km, W=5m, D=2m), New excavation of Khal (L=1km, W=5m, D=1.5m)-Satbila -Balla UP	1 No. of 2-vent regulators	None	6,922
49	Madhupur	Paiska	C	39357040	Kuichamara Khal SP	DI	584	Re-excavation of Kuichamara Khal (L=1.5km, W=5m, D=1m). Start: Boiran river (Paiska bazar, and End: Kuichamara (Ramkrishnabari).	1 regulator at Paiskabazar.	None	3,908
50	Madhupur	Alokdia	C	39357090	Benai Beel SP	FMDI	756	Re-excavation of Benai Beel Khal (L=3 km, W=6m, D=1.5m): Start: Bagmara-Benai beel-Depbania beel-Dubail beel-Inai river. New excavation of Khal (L=1.5km, W=6m, D=2m): Start: Dubail beel-Inai river.	1 No. of 3 vent regulator at Bagmara.	None	6,985
51	Madhupur	Alokdia	C	39357100	Dubail Beel SP	FMDI	653	Re-excavation of Dubail Beel Khal (L=4km, W=5m, D=1.75m) and New excavation of Khal (L=2km, W=5m, D=2m)	1 No. of 2 vent regulator at Chapar kona.	None	6,696
52	Madhupur	Golabari	C	39357110	Katakhal Khal SP	DIWC	912	Re-excavation of Katakhal khal (L=7km, W=10m, D=3m) New excavation of khal (L=0.5km, W=5.0m, D=1.75m).	3 Nos. of 1 vent and 1 No. of 3 vent regulators. one regulator at Boil beel, one regulator at Nakli beel, one regulator at Bagajora beel and one regulator at Tetulia beel	None	22,777
53	Madhupur	Golabari	C	39357130	Debipur Khal SP	DIWC	288	Re-excavation of Debipur khal. Start: Debipur, and End: Debipur Boiran river. L=1 km, W=10m, D=3m.)	One regulator at Debipur	None	4,974
54	Mirzapur	Jamurki	C	39366010	Lohajang Khal SP	DI	686	Re-excavation of Lohajang Khal: L=6km, W=60m, D=1.8m	None	None	21,385
55	Mirzapur	Banail	C	39366020	Nordana Khal SP	DI	659	Re-excavation of Nordana Khal: L=8km, W=22m, D=1.8m	None	Regulator be BDB	11,232
56	Mirzapur	Anaitara	C	39366140	Barinda Bazar - Atiamahmudpur - Kumulli Beel - Bodebharna - Nadona Khal SP	DI	302	Barindabazar-Atiamahmudpur-Kumulli beel-Badebharna-Nadona khal. L=3 km, W=25 m, D=1.8 m.	None	None	8,324
57	Nagarpur	Salimabad	C	39376020	Modhudewan Khal SP	WC	209	None	1 sluice gate at Salimabad Pashchimpara.	None	3,600

Table 5.1 List of Potential Subprojects for SSWRDP in Tangail District (6/6)

SR. No.	Upazila	Proposed union	Priority	SP_ID	Title	Type	Gross Area (ha)	Expected Work Volume		BWDB Project	Investment Cost (Tk. '000)
								Earthworks	Structure		
58	Nagarpur	Dhuburia	C	39376040	Dhubaria-Balarampur Khal SP	WC	512	Re-excavation of Dhubaria-Balarampur Khal (L=7 km, W=15m, D=3m)	None	None	12,932
59	Nagarpur	Sahabatpur	C	39376070	Nalsanda-Khamardholla Flood Management SP	FM	521	Rehabilitation of emabnkment at Narsanda-Khamardholla L=5km, W=4m, H=1.5m	1 sluice gate at Tokadair	Bharra-Bet wajani Embankment	5,961
60	Nagarpur	Sahabatpur	C	39376110	Tokadair-Sahabatpur Khal SP	DI	399	Excavation of khal. Tokadair-Sahabatpur (New).L=3 km, W=8 m, D=4 m.	1 sluice gate at Kokadair.	None	8,905
61	Sakhipur	Hatibandha	C	39385060	Goalia River SP	FMDI WC	925	Reexcavation of Goalia khal-Hatibandha. L=3 km, W=22 m, D=1.5 m	One regulator at Bajail.	None	20,046
62	Sakhipur	Gazaria	C	39385080	Goalia Jhara Khal SP	DI	1080	Re-excavation of Goalia Jhura Khal: L=4km, W=22.5m, D=1.35m	None	None	4,182
63	Tangail Sadar	Baghil	C	39395030	Basiria Khal SP	DIWC	245	Re-excavation of Basuria Khal: L=3km, W=13m, D=1.5 m	One regulator at Basuria.	None	5,767
64	Tangail Sadar	Dyenna	C	39395070	Binnafoir Khal SP	DI	503	Re-excavation of Binnafoir Khal: L=10km, W=25m, D=1.5m	None	CPP embankment	12,908
65	Tangail Sadar	Dyenna	C	39395080	Shingerghona - Ghotokbari - Boro Beel - Dhara Kutia SP	DI	292	Re-excavation of khal: L=4.5km, W=4m, D=1.8m	None	CPP embankment	1,714
66	Tangail Sadar	Karatia	C	39395110	Lahajong Khal SP	DI	733	Re-excavation of Lahajong Khal: L=10km, W=30m, D=1.8m	None	None	18,588

Table 5.1 Major Development Possibilities of Agroecological Zones in Tangail District

No	Region	Major Development Possibilities						
		Agriculture	Fishery	Livestock	Water resources	Infrastructure	Socio economy	Forestry/ Environment
2	Terrace Areas (AEZ-28: Madhupur Tract)	The region is no longer subject to inundation by normal flooding. The soils are comprised of Madhupur clays. The dominant cropping pattern is two rice crops followed by a rabi crop.	Open water and closed water fisheries	Duck, poultry (mainly layer and broiler) farm.	Surface water storage by dyking hill streams..	Improvement of all weather road communication, housing and settlements, market places etc.	Improvement of social amenities.	Protection of poor masses.
3a	Floodplain Areas (AEZ-9: Old Brahmaputra & Jamuna river)	Rice based agriculture is the main economic output of the area and increased production is caused by inadequate pre-monsoon and post-monsoon drainage. On-going sediment deposition in the drainage system will result in increasing crop losses in dry season.	Open water and closed water fisheries	Aqua animal (Duck in T.Aman field).	Planned expansion and efficient use of tube-well irrigation Multipurpose development of surface water.	Improvement of road communication, housing and settlements, commercial, administrative and educational centers.	Planned population settlement. Backyard poultry and kitchen, gardening to improve family income. Village banking to promote saving habit.	Protection against water and air pollution. Strict compliance of land use policy. Expansion of trees through annual programs.
4	Charlands, River Char Lands. (AEZ-7: Active Brahmaputra & Jamuna Floodplain)	Enhanced production systems on seasonally flooded areas. Intensive boro cultivation, green manure crop.		Boro+ Green fodder+Pasture/ Grazing field.	Limited power pump irrigation expansion.	Improvement of village roads. Development of marketing, primary education and health care centers and disaster centers.	Provision of social amenities and securities. Alternative employment opportunities to improve family income.	Planned population settlement, social forestation.

Table 5.2 Promising Farming in Various Areas of Tangail District

Zone	Characteristics	Promising Farming System
Characteristics of char area (Unstable)	The area is composed of sandy soil newly sedimented by river water, especially flooding. Almost no vegetation are appeared on the sand, and the land is eroded or sediment; therefore, the land itself are unstable/moving by flood.	Fishing is the major work, and it is performed all year round. However, crops of short growth periods can be grown in these areas during winter There are no permanent fields, but depending on land conditions short growing crops such as mustard and feed crops can be grown
Char area (Stable)	The soil of the area is silty- sand, and inhabited without scoring/erosion over 20 years. The agricultural land is porous and has high percolation. It needs frequent irrigation and fertilization. Through the field observation, costs of these inputs were generally 20% higher than ordinary soils. Organic substances in soils are less than other soils. Soil fertility is low but clean in biological infection	In Chadfassion, Bhola, water depth was decreased/ managed by the water works of the SSWRDSP-1. Areas of cropped land was not changed karge, but by its activities HYV of Aus and Aman were introduced instead of LT (Local variety Transplanted) The areas of HYV were increased from 90 ha at pre-project to 364 ha at post-post project. The area of Rabi decreased in the post-project. It indicates that the post-project cultivation still needs appropriate irrigation. Mungbean was changed to potato and lentil. In char area irrigation cost is about Tk. 4,000/acre, while in normal fields irrigation of Tk. 3000-3,500 /acre is required. Other costs are also estimated to be higher in char areas
Medium lowland	In the appropriate natural conditions integrated agricultural activities can be widely accepted by various combination of agriculture.	The integrated farming is useful for the development of rural areas. It has already been practiced in various areas , and successful cases are reported. Examples of development projects are: (1) Integrated rice-duck farming (2) Rice-fish farming
Medium highland	The area is flood-free or slightly flooded but no sedimentation area. Triple cropping is practiced in the area: Boro-Aman-potato/ vegetables. Due to Boro-Aman crop rotation, soil-born diseases or laterization are limited.	Examples of development projects. (1) Triple paddy + potato cropping after flood-free condition by SSWRDSP-1, Kanmona-Haraboti WCS Subproject, Kalai, Joypurhat> (2) Traditional potato farmers, Kishoreganj (3) Goat rearing by a rural woman of farm household.
Highland area	Highland areas are flood-free, but soil problems such as soil-nematode and laterization always happen. Water is usually supplied to soil only by rainwater. The water is short for crop growth, especially in winter.	Although natural conditions are severe, there are several promising farming systems in these areas. a. Perennial crops such as banana and pineapples b. Rice cultivation in depressed areas. c. High value-added crops can be cropped using DTW. d. Aman-vegetables-livestock (poultry) e. Crop rotation, ex. Eggplant-wheat-leek will be effective Due to no submerged conditions, damages by soil nematode are severe, crop rotation is important as well as chemicals to nematodes

Table 5.3 Potential of Development Fish Production by Agroecological Zone in Tangail District

No	Region	Potential of development fish production in SSWRD
2	Terrace Area (AEZ-28: Madhupur Tract)	<p>Generally it is a suitable for fish culture. If water remains in ponds/ditches/khals/rivers/beels more than 1m depth and minimum 6-10 months, Such site may be possible to introduce low cost subsistence fish culture or income generating fish culture such as;</p> <ul style="list-style-type: none"> • Closed water bodies- pond and ditch etc., <ul style="list-style-type: none"> ◦ Tilapia with Pangas poly culture, ◦ Integrated fish culture; major carps, grass carp or plankton feeder fish with chicken/duck and vegetable crop on the dike, ◦ Rice- com fish culture, ◦ Rice- com fish culture with duck, ◦ Poly fish culture (major carps, Indian carps, <i>pangus</i>, etc.,) <p><u>To need investment large amount of finance</u></p> <ul style="list-style-type: none"> ◦ Integrated fish culture: fish with chicken/duck (poultry house on the pond or side) and vegetable crop on the dike, ◦ Fresh water shrimp poly culture (shrimp with fish, except carnivorous fish) ◦ Fresh water ornamental fish poly culture (golden fish, fancy carp etc.,) ◦ Indigenous/natural fish culture (for natural resource propagation) <ul style="list-style-type: none"> • Open water bodies- Khal/ beel/river <ul style="list-style-type: none"> ◦ Khal: pen or cage culture of <i>pangus</i> or major carps ◦ Beel fish culture (stocking cultured fingerling only or with natural fish) ◦ Khal ,beel and river: Indigenous/natural fish conservation and capture by Katas/ pen (making habitat and fishing ground by some structure) ◦ Kuas in beel and khal (like small hole or pool, it becomes fish shelter in low level water)
3a	Floodplain Areas 8AEZ-9: Old Brahmaputra & Jamuna river)	<p>Generally it is a partly suitable for fish culture. If water remains in ponds/ ditches/ khals/ rivers/ beels more than 1m depth and minimum 6-10 months, it may be possible to introduce low cost subsistence fish culture or income generating fish culture such as;</p> <p>Closed water bodies- pond and ditch etc.,, if the flood doesn't break the pond or ditch.</p> <ul style="list-style-type: none"> • Closed water bodies- pond and ditch <ul style="list-style-type: none"> ◦ Tilapia with <i>Pangas</i> poly culture, ◦ Integrated fish culture; major carps, grass carp or plankton feeder fish with chicken/duck and vegetable crop on the dike, ◦ Rice- com fish culture with duck, ◦ Poly fish culture ◦ Indigenous/natural fish (fish naturally enters the pond due to a flood) and stocking fish culture <p><u>To need investment large amount of finance</u></p> <ul style="list-style-type: none"> ◦ Integrated fish culture: fish with chicken/duck (poultry house on the pond or side) and vegetable crop on the dike, ◦ Fresh water shrimp poly culture (shrimp with fish, except carnivorous fish) ◦ Fresh water ornamental fish poly culture (golden fish, fancy carp etc.,) ◦ Indigenous/natural fish culture (for natural resource propagation) <ul style="list-style-type: none"> • Open water bodies- Khal/ beel/river <ul style="list-style-type: none"> ◦ Khal: pen or cage culture of <i>Pangas</i> or Major carps ◦ Beel fish culture (stocking cultured fingerling only or with natural fish) ◦ Khal ,beel and river: Indigenous/natural fish conservation and capture by Katas/ pen (making habitat and fishing ground ◦ Kuas in beel, khal (like small hole, pool, it becomes fish shelter in low level water) by some structure) and Kuas
4	Charlands, River Char Lands (AEZ-7:Active Brahmaputra & Jamuna Floodplain)	<p>It is not suitable for fish culture. But fishing can be conducted at open water surrounding the area to get protein and income.</p> <ul style="list-style-type: none"> • Open water bodies- Khal/ beel/river <ul style="list-style-type: none"> ◦ Rivers: Indigenous/natural fish conservation and capture by Katas/ pen (making habitat and fishing ground by some structure) ◦ Rivers: Floating cage culture ◦ Rivers: Collecting natural fish seed/fry for sale or own fish culture

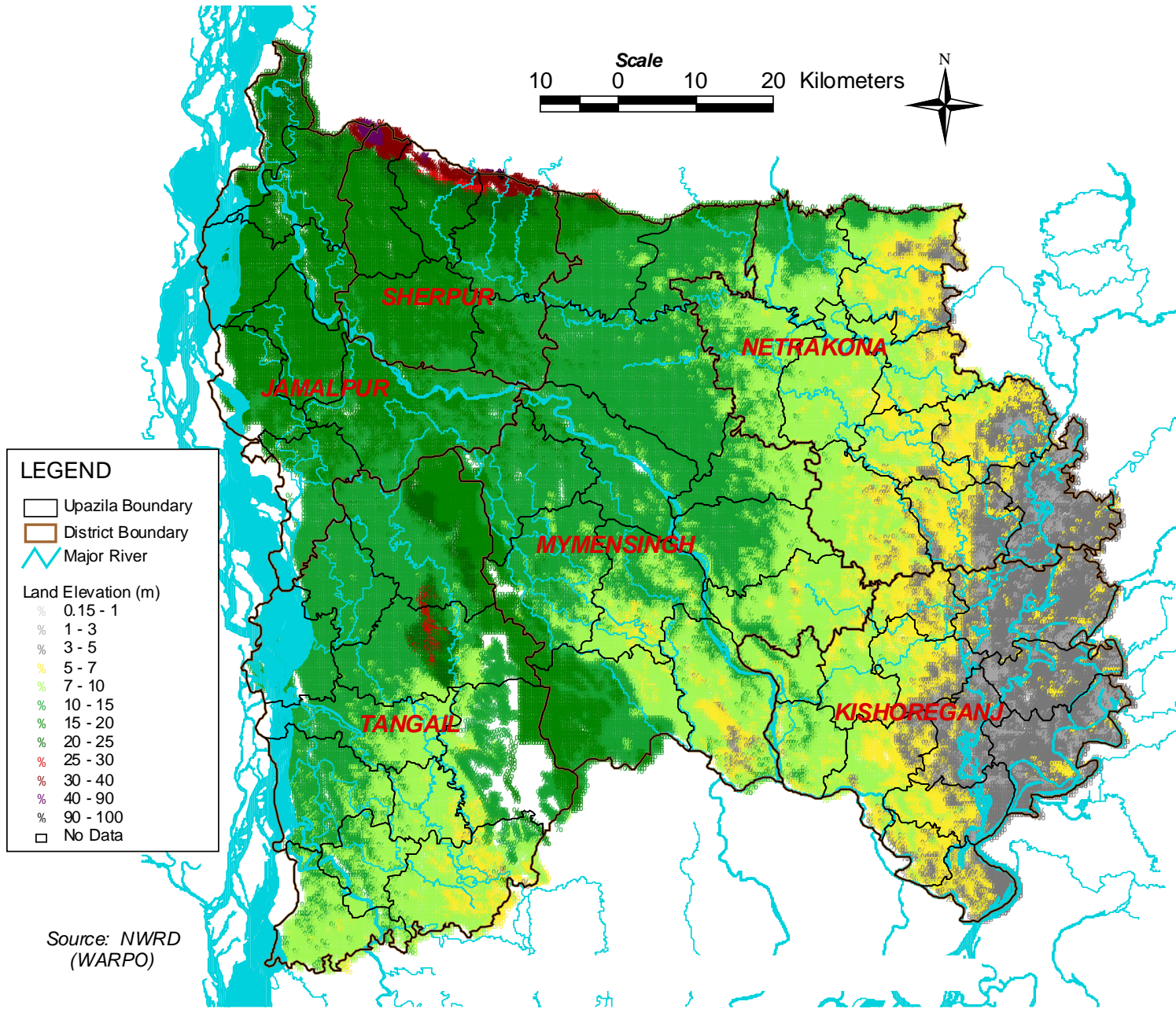
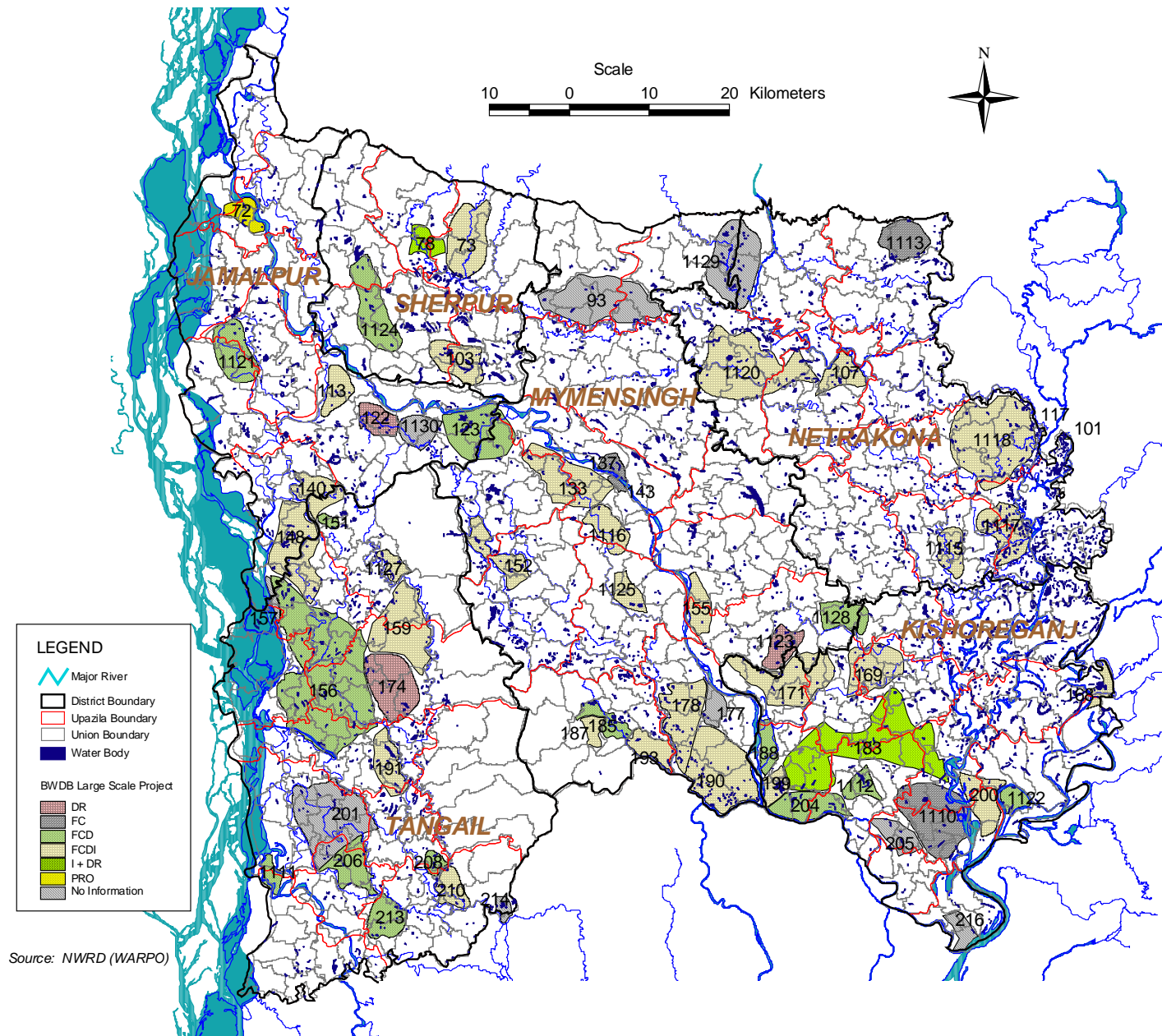


Fig. 2.1 Topographic Map of Tangail District and Study Area



Source: NWRD (WARPO)

Fig. 2.2 Perennial Water Bodies and Large Scale Water Resources Development Projects in Tangail District and the Study Area

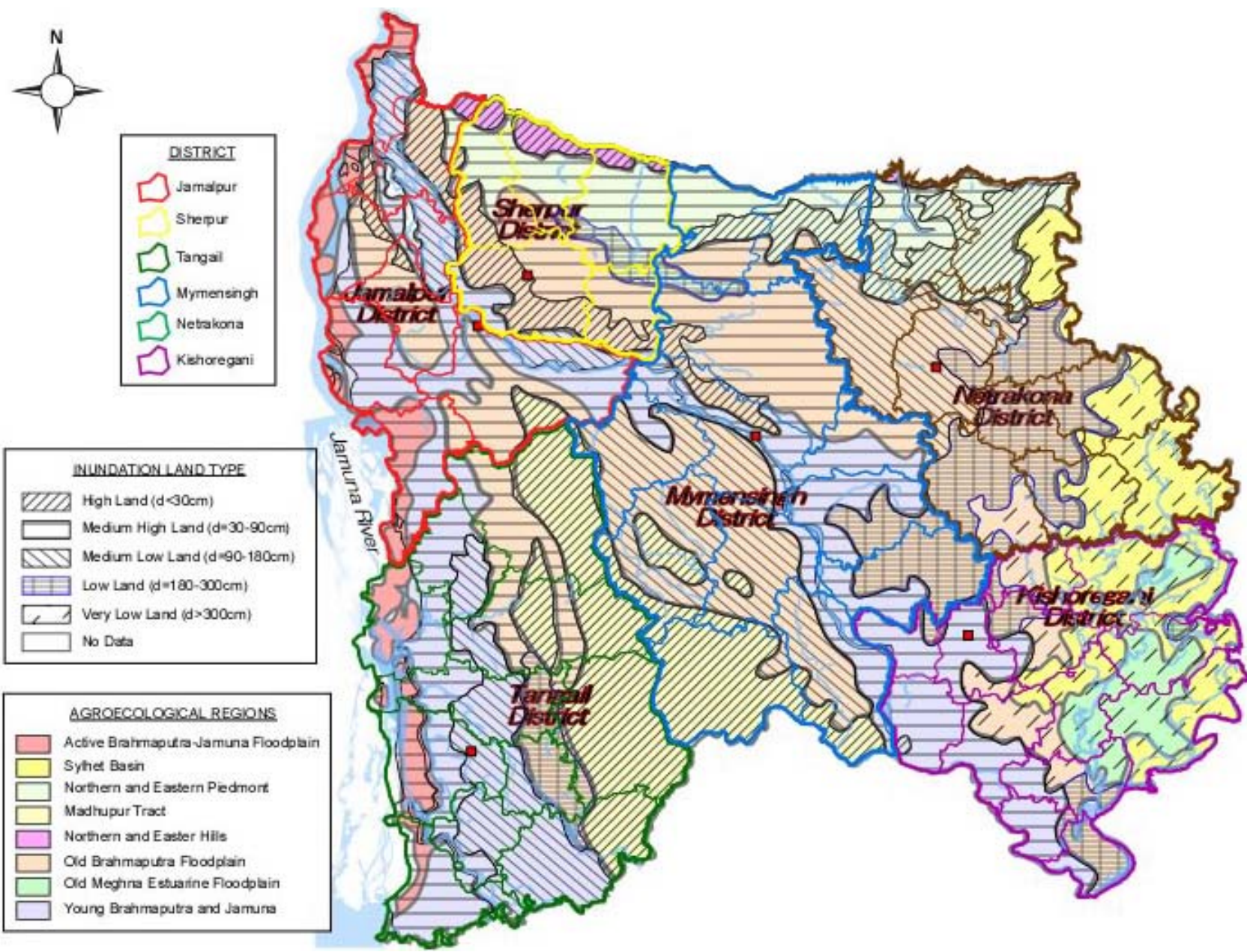
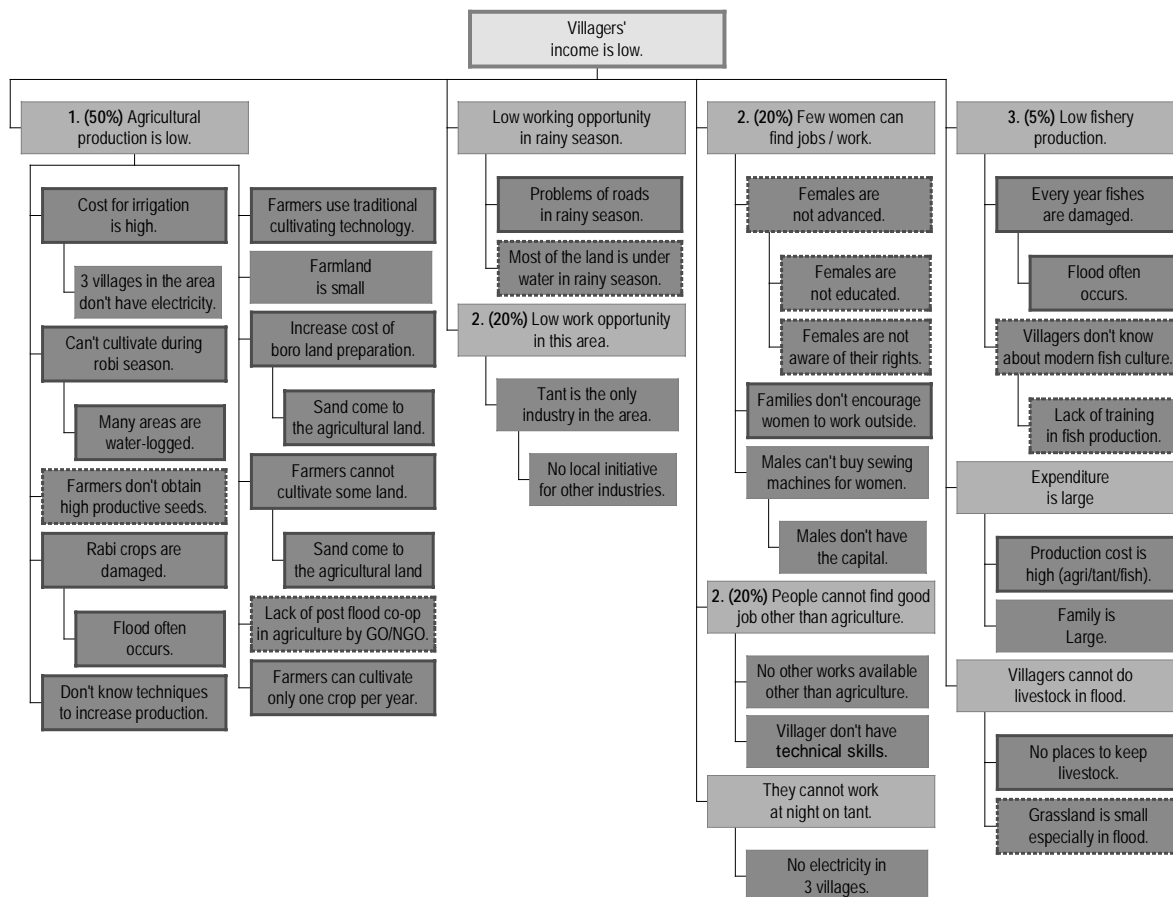
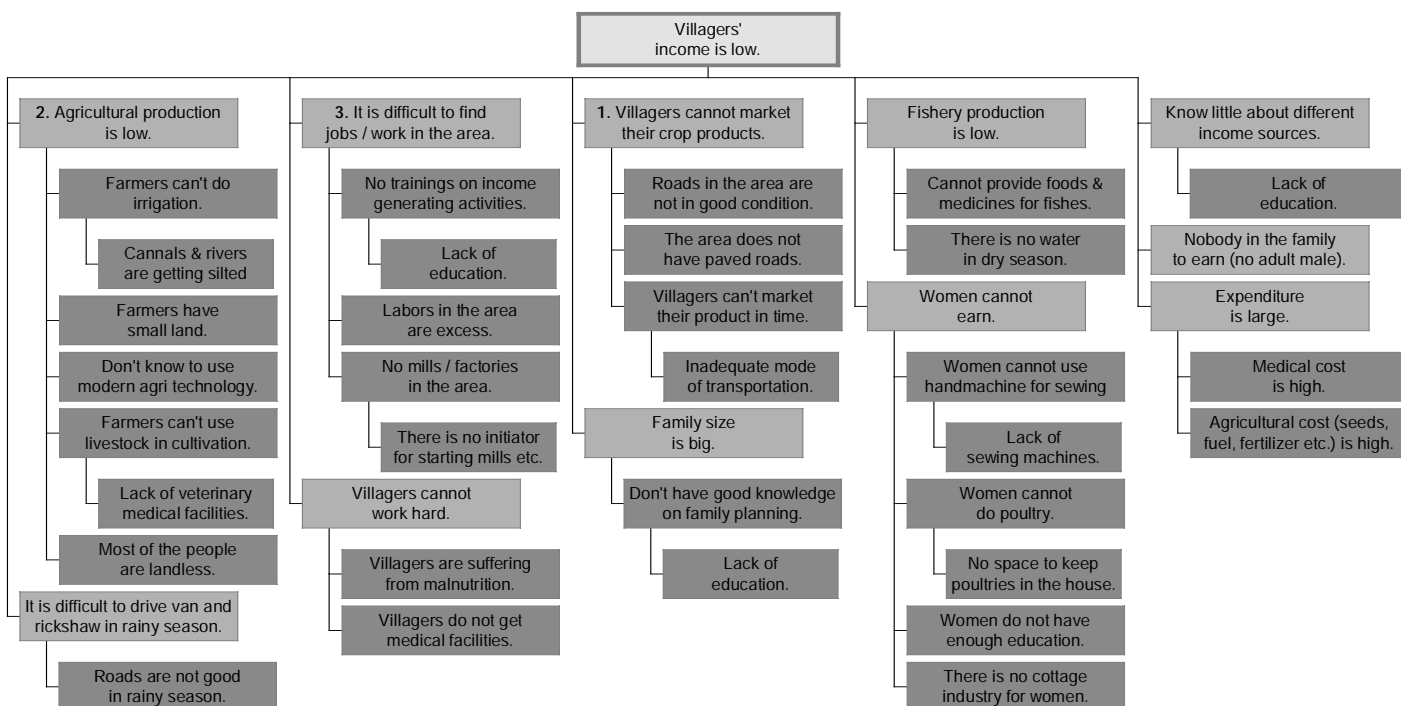


Fig. 2.3 Zoning of Tangail District and the Study Area



A. Ratanganj Village, Nagbari Union, Kalihati Upazila, Tangail District (9 September 2004)



B. Rasulpur Union, Ghatail Upazila, Tangail District (10 September 2004)

Fig. 3.1 Problem Trees of Union Level Workshops in Tangail District

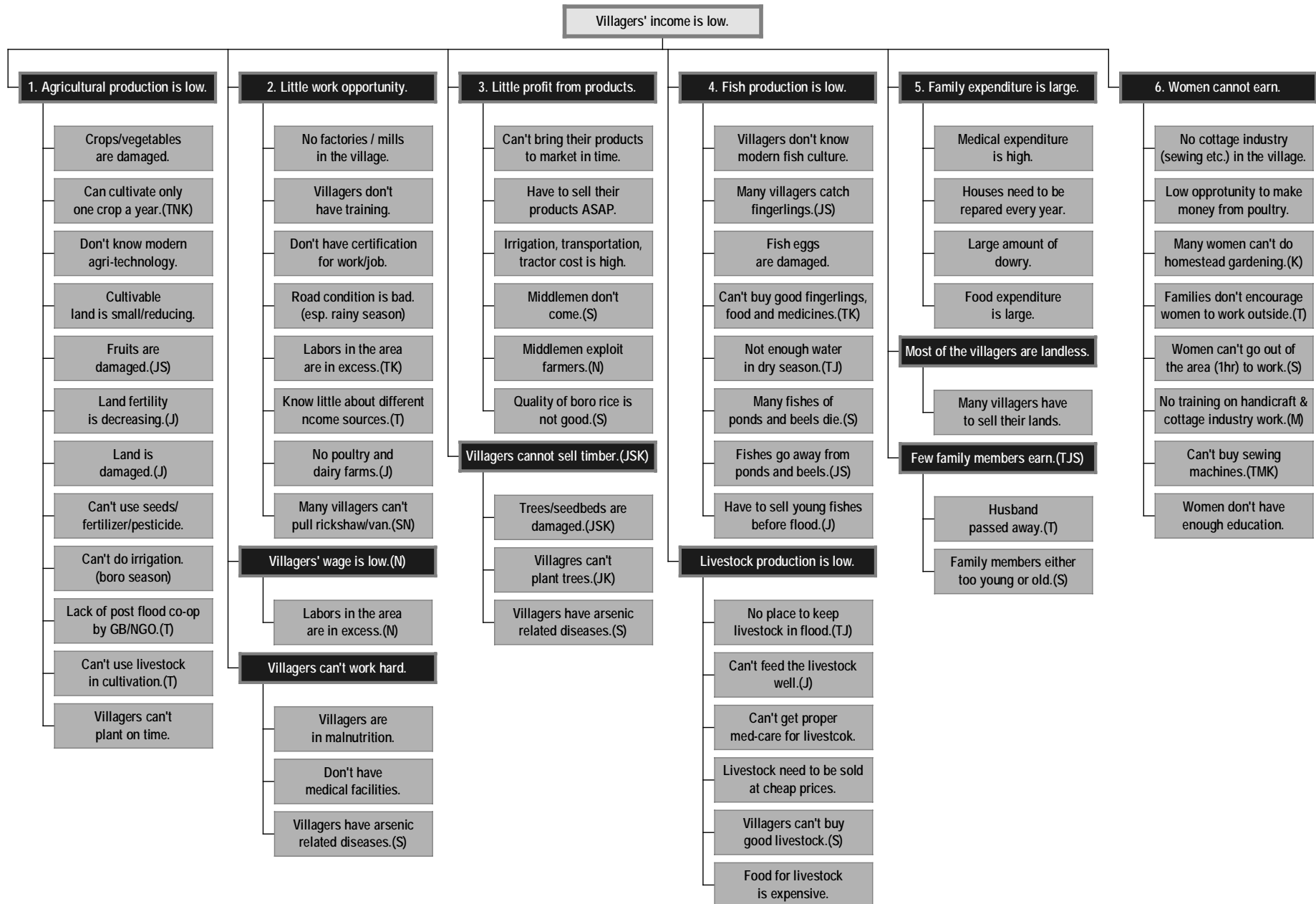


Fig. 3.2 Problem Trees after Problem Analysis in the Study Area